On

HYDATID DISEASE, with special reference to ITS INCIDENCE IN INDIA, and an ACCOUNT OF SOME CASES.

being

A Thesis for the Degree of M. D.

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by

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P R E F A C E.

During the years 1900 to 1905, I was in joint charge of a hospital in Jammalamadugu, a town in the Cuddapah District of the Madras Presidency, South India, and in the midst of what is known as "Ceded Districts." My colleague, Dr. J. D. Campbell, has been at work in this district since 1891.

Towards the end of 1904, I was much attracted to the subject of Hydatid Disease, as we had had, in the course of our practice, several cases under our care, nearly all of which had occurred in rare situations, and all of which were situated in different organs.

In the course of my reading on this subject, I found that the opinions, regarding the incidence of this disease in India, differed very widely, and that no serious attempt had been made to discover to what extent and in what parts of the country the disease existed. I thought it, therefore, instructive as well as interesting to make an inquiry on these lines.

I have, by means of a wide correspondence with doctors practising in the different parts of India, by conversations with others practising in South India, and by searching the literature of the subject, as well as obtaining the statistics of the large hospitals, been able to obtain results, which will establish the fact that Echinococcus disease is not so rare as has been supposed in India, and that in two areas, it is endemic.

Dr. Campbell has kindly consented to my recording the cases, which have been under our joint supervision, and which have not been hitherto published, that will be found at the end of this work.

I have thought it advisable to insert the references in the body of the thesis, at their proper places, instead of writing a bibliography at the end. All the originals have been consulted where possible.

Ernest W. Lewis.

C O N T E N T S.

ILLUSTRATIONS.

H I S T O R I C A L S K E T C H.

Hydatid Disease is one that has long been recognised, though its animal origin and true pathology are discoveries of a comparatively recent date. The distinctive feature of the condition - the little, or perhaps larger bladders, filled with water, some containing smaller bladders - is so prominent, that it cannot be overlooked. The disease is, therefore, easily recognisable during life if bladders should be discharged, or post mortem if the cyst is opened into.

In his aphorisms, Hippocrates writes "When the liver is filled with water and bursts into the Epiploon, in this case the belly is filled with water and the patient dies" (Aphor. Sect.7,No.55). This aphorism is supposed by many to refer to hydatid disease. Thus Galen, in his treatise on the works of Hippocrates, comments on it and supposes the author to be refering to this disease.

Oretaeus, a noted physician of the 1st. century, in writing on different forms of ascites, says " Small and num--erous bladders full of fluid are contained in the place where ascites is found; but they also float in a copious fluid, of which this is a proof, for if you perforate the abdomen so as to evacuate the fluid, a bladder within will block up the passagebut if you push the instrument farther in, the discharge will be renewed. This species then is not of a mild character, for there is no ready passage by which the bladders might escape. It is said however, that in cer-

-tain cases such bladders have come out by the bowels." (Sydenham Society's translation of the works of Aretaeus, p.337).

Bladder-worms were called, by acient physicians, χάλαξαι hailstones (Ray Lankester, "Treatise in Zoology").

From these references, we see that the condition was known to the best of the early physicians, though in the middle ages and even on into the 18th. century, the term "hydatids" (derived from the Greek ὕδατις a drop of water) was applied to more or less thin walled sacs containing fluid, other than true hydatids. For example, Paulus Aegineta mentions an operation for removal of hydatids from the eyelids and says that "the hydatid is a fatty substance." It is doubtful therefore if he means true hydatids (Sydenham Soc.'s translation, "The seven books of P. Aegineta, vol. 2, p.270). Again, Haller refers to "hydatides in vagina vidi," meaning not echinococcus cysts, but other collections of fluid (Elementa Phys. Corpor. Humani," T.7, Bernae, 1757-60).

Just as the disease produced by these bladders was known and described by early writers, as above mentioned, so the tape-worm was known to be a parasite, inhabiting the intestine of man and many animals. It is instructive to trace the history of the researches which led to the discovery that hydatids are really a larval form of a particular tape-worm which is found in the intestine of dogs.

In the olden days, the first distinction made between the various classes of entozoa was that between round-worms and flat-worms. Aristotle and Hippocrates both made this

distinction, calling round-worms ἕλμινθες πλατειαι and the flat_worms ἕλμινθες στρογγύλαι (Cf. Hippocrates' Aphorisms sect.3, Aristotle's "Researches about Animals" "περι τα ζῷ ιστορια", Hippocrates, "Lib.4, de Morb.Artic.c.27." Aristotle "Hist.Anim." l.5c.19)

The term ταινια was first applied to the Cestoda by Roman writers, such as by the elder Pliny, in his "Historia Naturalis" (vide book 9, cap.8)

During the middle ages, all cestodes were grouped together under the one class "Lumbricus Latus", their connection with bladder worms not being suspected. The first species to be separated from this class was the Bothriocephalus latus, which was distinguished from the other cestodes in 1601, by Plater (in his "Opus Praxeos Medicae"). In the early times and middle ages, intestinal parasites were supposed to arise by spontaneous generation ("Generatio Aequivoca") and dis--cussions took place as to whether the organism arose from an egg, or occurred as an adult at once, also as to what gave rise to this organism. At one time, the blood and juices of the body were supposed to be the material out of which the organism developed; at another time , the excretion of the alimentary canal, or digested food was said to be the origin Then again, "it was disputed as to whether fermentation or putrefaction or a special organising principle gave the first impulse to its creation" (Leuckart "Parasites of Man", Hoyle's translation 1886, p.23) Hartman says that obstruction of the gall bladder is the occasion of flat-worms (Hartman "Pract.Chym." p.202).

Andry, in a book on worms, written towards the close of

the 15th century, classifies worms as follows:-"The gut-worms are of three sorts, some round and long, others round and short, and a third sort broad. The round and long ones breed in the small guts and sometimes in the stomach: the second sort breed.in the intestinum rectum and are called Oscarides. The flat gut-worms are hatched either in the pylorus of the stomach or in the small intestines and are called Taeniae from their resemblance to a ribband..... There are two sorts of taenia's; one properly so called that neither moves nor has any form'd head; the other called solium (Sennertus, lib.3 par2, sect.1) from its being the only one of its species in the body, which moves and has a very regular round head resembling a wart. The taenia properly so call-ed, breeds in the small guts, from whence it extends to the rest. Even when it is entire, we can descry no head upon it."

In the 17th. century, some light was thrown upon the origin of the parasites by the work of Swammerdam and Reddi. Previous to their time it was believed that sexual generation was confined to the higher animals, but Reddi proved that maggots were the larvae of flies which only developed when fully formed insects were allowed access to deposit their eggs("Esperienze intorno agl' insetti",t.1,p.23), whereas Swammerdam showed that lice were developed from eggs("Bibel der Natur",p.37). Even these writers , however, could not shake off the hold that the theory of "generatio aequivoca" had obtained over them. During the 17th century, many naturalists worked at the subject of these tape-worms, and the theory of their"heterogenous development"began to gain

ground. Linné believed that some animals lived sometimes freely and sometimes as parasites. He had seen a tape-worm in water, which he took to be a young and incomplete specimen of the adult worm found in the human intestine. Again, he thought that the liver fluke lived in water and in the liver of the sheep, the ascaris vermicularis in the roots of decay-ing plants and in the intestines of boys and horses ("Systema Naturae," Ed.10, T.1, p.648).

The animal nature of bladder-worms seems to have suggest-ed itself to Redi in 1684 and to Hartmann in 1685 and to Tyson in 1691, to each independently (Verco & Sterling, "C. Allbutt's "Syst. of Med." Vol.2, p.1102).

The best work on this subject, at this time, was done by Pallas, who recognised a relationship between taenia and bladder-worms. In 1767, he wrote "It seems to me very prob-able that the incompletely developed water-vessicles seen by many observers in the human body, such as those oftenest seen in pathological cavities of the liver are caused by and arise from a worm resembling our own tape-worms" (Stral-sunder's Magazin," I, p.81). He put forward the theory that entozoa, like other animals, originate from eggs which can be transferred from one animal to another. He again writes "it cannot be doubted that the eggs of entozoa are scattered abroad and undergo various changes without loss of vitality and that immediately they reach the body of a suitable an-imal through the medium of its food or drink, they grow into worms" ("Neue Nord. Beitrage," Ed. I, p.43). Pallas believed that the blood stream carried eggs, which entered

the blood-vessels from the intestine, to all parts of the body.

As early as 1733, Vallisnieri had propounded the theory that entozoa might be inherited, that is they might be trans--mitted to the embryo in utero ("Opere fisico med."T.1). This theory received the support of many naturalists including Andry and, later on, Pallas, Muller ("Naturforscher",Bd.14,p. 195),Bloch ("Abhandlung von der Erzeugung der Eingeweidewurmer" p.37,1782) and Goeze ("Versuch einer Naturgeschichte der Eingeweiderwurmer",p.4 etc,1782). Cases have been recorded in which entozoa have been found in the embryo while still in utero. Davaine, in his "Traite des Entozoaires," gives a list of such cases(1877 ed,p.11). It was then believed that entozoa were transmitted from the parent to the off-spring and that the eggs extruded from the body with the foeces were lost as far as the parasite was concerned. Pallas, however, could not support this theory, as the cases in which the entozoa had been found in the embryo in utero were so rare. He thought that the eggs evacuated with the foeces were concerned with the transmission of the parasite as much if not more than the directly transmitted eggs. He was sup--ported in this view by Doeveren (in his book"Abhandlung von den Wurmer in den Cedarmen des Menschlichen Korpers",1775, p.10b et seq.). Pallas,Bloch and Goeze all attempted to decide certain questions as to the generation of entozoa by the experimental method, but their results were not good and this method of research remained unused till Kuchenmeister's time.

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In spite of the discoveries and writings of these not-

naturalists, there was a swing back to the older theory of spontaneous generation, for we find such men as Rudolphi teaching that "vital force" was sufficient to organise a mass of mucus or an intestinal villus into a bladder-worm instead of a simple hydatid (Leuckart "Parasites of Men" Hoyle's trans. p.28-9).

In 1782, Goeze confirmed Pallas' opinion that there was a connection between bladder-worms and tape-worms. He showed that the heads of the former really belonged to the taeniae and possessed hooks and suckers ("Versucheiner Naturgesch." p.158). These heads were looked for by other observers and not found. Thus Laenec unable to see these hooks and suckers classed these animals amongst the lowest types and termed them "Acephalocysts" in 1804 ("Mém. sur les Vers visiér et principal sur ceux qui se trouvent dans les corps humain"). The heads were redemonstrated by Bremser in the hydatids of man in 1821.

We see then that it was not till towards the end of the 18th. century that a connection between the bladder-worms found in the body and the tape-worms found in the intestines began to be realised. Meanwhile, opinions as to the innocuousness or otherwise of entozoa varied greatly. In the 17th. and 18th. century, parasites were looked upon as the originators of all manners of evil, none being too bad for them. Dysentery, scurvy and hydrophobia even, as well as the dangerous epidemics (plague and small-pox) of the middle ages were sometimes attributed to parasites (entozoa). Andry and other noted observers held these views. ("Traite sur la

generation des Vers dans le corps de l'homme" 1700).

Towards the end of the 18th. century, entozoa were re-garded as harmless and, by some, even as beneficial to the host. Men like Goze and Hildgaard maintained among other views, that intestinal worms aided digestion, by absorbing mucus and exciting peristaltic contractions. Jordens ("Entomologie und Helminthologie des menschlichen Korpers") even called them the good angels and unfailing helpers of children" (Leuckart, loc cit. p. 121). A little later on, Bremser attributed the origin of worms to an already diseased state of the organs. He says "worms in the alimentary canal are not an original disease and indeed can only rarely be regarded as a disease at all, but are much more frequently the sign of a diseased state of the organs in question, or of some interruption in the cooperation of these organs, from which state many results may arise without the presence of worms" ("Lebende Wurmer im lebenden Korper", p. 119).

As already stated, till the beginning of the 17th. century, all flat worms were classed together under the term Cumbricus Latus. From these Bothriocephalus Latus was separated by Plater in 1601. As already quoted, Andry mentions these two classes, and puts the bothriocephalus latus down as the "true taenia". The tape-worm was at this time looked upon as a compound animal, a view held long before by the Arabian physicians. The tape-worm was supposed to arise by numbers of of individual segments, which afterwards joined together to-gether to form a chain. Linné compared thhe animal to a plant with many shoots ("Amoenit. acad." vol. 2, p. 87 et seq.).

The idea of the compound nature of the animal then gave way to the idea that it was a simple animal. Steenstrub, writing in 1842, says, "However, I cannot for my part entirely coincide with this view of the Cestode family of worms, for in whatever way the joints and their recibrocal connection are considered, compound animals are presented, whose con--struction is entirely different from that of all other an--imals. The tape-worm is certainly not a single individual, but consists of several; that is it is constituted of the head which is an animal, and of the progeny derived from it. This view is much supported, it is even proved by the fact that the offspring (joints), in a state of progressive de-velopment, never actually become animals similar to that from which they spring(the cephalic joint) which alone re--mains dissimilar to all the rest., never acquires any de--veloped sexual organs, and consequently never generates any ova, which the others produce in great abundance." (Steenstrub Ray Soc. translation, "Ueber den Gener," 1845, p.103).

Rudolphi distinguished five distinct classes of Helminths, tape-worms and bladder-worms being two of them. Of the Cestodes, the echinococcus was the last to be described owing to its small size. It had been noticed before it was described by von Siebold. The latter gave his description of it in 1853, but Rudolphi had seen it in a pug dog and had mistaken it for a young tape-worm common in the dog, Taenia Cucumerina ("Entozoor. hist. natur." T. I, p.411, 1808). Van Beneden described it as an independent species in 1850, calling it Taenia Nana ("Mém. sur les vers intestin." p.158).

Between the years 1830-1860, great strides were made in the knowledge of tape-worms. In 1831, Mehlis discovered by means of the microscope, that the eggs of certain Distomidae contained embryos. He then discovered that these embryos could be hatched out, and could swim about in water like Infusorians("Oken's Isis",1831,p.190). This observation was confirmed the next year by Van Nordmann, who stated that these parasites "always sojourn during their first life period in water, and subsequently enter the body of some animal, where they lose their eye-specks and become sexually mature" ("Mikrographische Beitrage",Bd.2,p.140). Von Siebold extended his investigations to the Nematodes and the Cestodes, and he discovered, amongst other things, that the eggs of the tape-worms contain embryos before they are passed out of the body of the host. The embryos are totally different to the parent, being simply spherical masses, possessing stylet-shaped hooks (Burdach's"Physiologie",Bd.2.).

Eschricht continued these investigations and arrived at the conclusion that the life-history of the entozoa must be considered as analagous on the whole to that of the parasitic larvae of the ichneumon flies ("Ed.New Phil.Journal",1841). The year after this, in 1842, Steenstrup announced his famous theory of the"alternation of generations" ("Ueber den Generations wechsel",1842) He says"The special subject of this essay is the fundamental idea expressed by the words "alternation of generations," or the remarkable and until now the inexplicable natural phenomenon of an animal producing an offspring which at no time resembles its parent, but which, on the other

hand, itself brings forth a progeny, which returns in its form and nature to the parent animal, so that the maternal animal does not meet with its resemblance in its own brood, but in its descendants of the 2 d, 3rd, or 4th. degree or generation; and this always takes place in the different animals which exhibit this phenomenon, in a determinate generation, or with the intervention of a determinate number of generations. This remarkable precedence of one or more generations, whose function is, as it were, to prepare the way for the later, succeeding generation of animals, destined to attain a higher degree of perfection, and which are developed into the form of the mother and propagate the species by means of ova, can, I believe, be demonstrated in not a few instances in the animal kingdom" ("Ray Soc. Trans." Preface, p. 1)

"The mode of development by means of "nurses" or intermediate generations, is thus seen to be no longer an isolated phenomenon in nature. The circumstance of an animal giving birth to progeny permanently dissimilar to its parent, but which itself produces a new generation, which either in itself or in its offspring, returns to the form of the parent animal, is a phenomenon not confined to a single class or series of animal; the vertebrate class is the only one in which it has not yet been observed. It would consequently appear that there is something intrinsic in the mode of development and that it occurs as it were with a certain necessity; on which account it will undoubtedly soon be recognised to a greater extent and more generally." (ib. p. 105). After the announcement of this theory, which put forth that the sexual

stage of some animals is passed in one and the asexual stage in another host, Von Siebold and Van Beneden continued to work at the subject and the former came to the conclusion that the bladder-worms were pathological formations, caused by embryos losing their way ("Zeitschr.f.wiss.Zool."Bd.2,p.198). Van Beneden, in his book "Les Vers Cestodes," published in 1850, maintains, however, that the bladder-worms are not pathological conditions, but that in structure they are closely allied to the head of the tape-worm.

It was not with ease that the idea of transmigration took root. It had been suggested long before,by Rudolphi, that this was possible. Van Beneden says,"the idea of inevitable transmigration was so completely unknown that Bremser, the first helminthologist of the day, raised the cry of heresy, when Rudolphi spoke of the Cigulae of fishes which could continue to live in birds. At a period nearer to our own times, our learned friend Von Siebold, deservedly called the prince of helminthologists, was entirely of this opinion and compared the cysticercus of the mouse with the tape-worm of the cat, considering the young worm as a wandering, sick and dropsical being. In his opinion, the worm had lost its way in the mouse, as the taenia of the cat could only live in the cat. Flourens considered it a romance when I myself an--nounced to the Institut de France, that cestode worms must necessarily pass from one animal to another in order to complete the phases of their evolution" ("Animal parasites and messmates," Internat.Series,1889 ed.,Introd.p.22-3.).

In 1851, Kuchenmeister performed his celebrated feeding experiments, thereby proving definitely the relationship of

tape- and bladder-worms, and putting an end to the hard dying theory of spontaneous generation ("Ueber die metamorphose der Finnen in Bandwurmer," Prager Vietel-jahreschrift, 1852). Kuchenmeister's first experiment was to feed a dog with bladder-worms from a rabbit and a cat with bladder-worms from a mouse. In both cases, he was successful in rearing tape-worms. In 1852, Von Siebold, as well as Kuchenmeister himself, succeeded in rearing taenia echinococcus from bladder-worms derived from domestic animals.

Although Kuchenmeister, Zenker and Cevisón fed dogs on human hydatids, they could not succeed in producing the adult taenia echinococcus. In 1863, however, Naunyn was successful in rearing the tape-worm by feeding a dog with the contents of an echinococcus obtained from a human liver, which was known to contain living scolices (Muller's "Archiv. f. anat. u. physiol. 1863, p. 412) After 30 days had elapsed, numerous taeniae were found in the intestine. This experiment has been confirmed by Krabbe and Finsen in 1865 and more recently by Thomas in Australia. Cobbold was unsuccessful in his attempts. One of his dogs "was liberated by some ill-disposed person" before he could kill it (Cobbold "Parasites of man & animals," 1879, p. 113).

In 1853, Kuchenmeister fed a wether with the ripe proglottides of a tape-worm, which had been reared experimentally and succeeded in producing bladder-worms (Coenurus), but the experiment with proglottides of taenia echinococcus was carried out without success in the case of lambs, sheep and goats, by Leuckart and Haubner. In 1862, however, Leuckart succeeded in producing hydatids in a pig from the ripe proglottides of a worm that had itself been experimentally reared (Hoyle's translation, p. 594). These experiments were confirmed by Naunyn.

LIFE HISTORY and DESCRIPTION of the PARASITE.

The life-history and development of taenia echinococcus and the hydatid bladders have been worked out by von Siebold, Kuchenmeister, Van Beneden, Busk, Huxley, Cobbold, but specially by Leuckart and Naunyn. The two latter specially studied and described the development of the six-hooked embryo into bladder-worms. To these two observers we owe most of our knowledge on this subject, and the description given by Leuckart in his work "Die Parasiten des Menschen", has been very little added to since. (Hoyle's translation, 1886).

Before beginning the description of the parasite, it will be well to outline the life history of taenia echinococcus. Leuckart says "There are no intestinal worms, at least amongst typical and constant parasites, whose embryos come to maturity near the parent, or in other words, there are none which pass their whole life cycle in one locality" (loc.cit.p.49). Taenia echinococcus is no exception to this general rule, for the adult worm has been found only inhabiting the intestine of dogs (Rudolphi, first), wolves (Cobbold "Parasites of man & animals", 1879, p.112) and jackals (in Egypt, Panceri), whereas the larval stage has been found in many different mammals, with the exception of the dog. The mature worm casts its last segment, which passes out with the foeces of the dog. The eggs thus escape from the host enclosed in a living cou-ering, the proglottis. The proglottis is capable of a certain amount of locomotion, and so is able to distribute the the contained ova. A moist environment is necessary for the further development of these eggs. The time required

for the development of the eggs varies in different species and even in different members of the same family. Eventually eggs are swallowed with the food or drink of some animal and are conveyed to the stomach of their "intermediate host". It may even be that the whole proglottis is swallowed by this intermediate host. The time that elapses between the deposition of the eggs and their reception into the stomach of the intermediate host is sometimes called the "passive migration stage"(Leuckart, loc.cit.p.65).

If the eggs are enclosed in the proglottis, the latter is soon digested off and the eggs liberated. If the eggs themselves are swallowed, their wall is soon digested off and the young embryos set free. Leuckart's experiments with the eggs of tape-worms show clearly that the hatching of the embryo is sometimes "merely a question of the digestive activity of the host"("Glasewurner"p.100). When liberated the embryos enter upon a stage of activity, "active-migration", and find their way into different organs. Some tape-worm embryos show a particular preference for certain tissues, as the cysticercus, others again, may enter any organ or tissue. When the embroys have found their way to a suitable site, they enter upon the"quiescent stage". This never occurs in the intestines (Leuckart, loc.cit.p.70). Van Beneden has discovered proscolices with scolices in all stages of growth, however, in the intestines of the lump fish, (Cyclopterus, "Vers Intestineaux"p.242 et seq.).

The quiescent stage may last a very long time, Cases have been recorded in which healthy hydatids have been re-

-moved 30 years after the symptoms due to their existance were first noticed. On case has been recorded in which the condition was known to exist for 43 years (Raynal, cited by Leuckart, loc.cit, p.643) Murchison refers to a case of Budd's in which an old lady died at the age of 73 in whose body two hydatid tumours were found which, there was reason to believe, had existed since she was 8 years old (Murchison "Clin. Lect. on Diseases of the Liver" p.58).

Sooner or later, the larvae, the echinococcus or hydatid, may be eaten with the food of a dog, wolf, or jackal. Should this take place, the cyst wall is digested off and the scolices which have developed within the cyst are liberated. They fix themselves to the mucous coat of the intestine and develope into the adult worm, thus completing the life cycle.

Leuckart remarks, when considering the life history of the tape-worm, that "a change of host is by no means a necessity in the life-history of all entozoa" (loc.cit. p.40). Of this Rolleston gives examples, "Archigetes, however, is the example of the sufficiency of a single host.....Taenia solium may exist in the flesh of man in the cysticercus stage, in the alimentary canal, as the adult tape-worm" ("Forms of Animal Life," p.233) He goes on to say "Why there should be two hosts, is a most obscure question....Moniez has broached the idea that a change from one host to another is, in these animals, which are so completely parasitic and therefore dependent, necessary to maintain their vigour" ("Moniez, "Les Cysticer." pp.135-154)

As a change of host is not an absolute necessity in some forms of worms, it would seem, as Rolleston writes, that "the

view that proscolex and scolex are parts merely of a non-sexual worm which become sexual on transference to a new host is more probable than that there is an alternation of gen-erations"("Forms of An.Life",p.b57).

Gamble, writing in te "Cambridge Natural History"(1896), remarks "Zoologically, Taenia Echinococcus and T.Coenurus are interesting, since they exhibit an indubitable alternation of asexual generation in the larval state with a sexual adult stage"(p.80).

Description of the Parasite. Taenia echinococcus be-longs to the class of worms called Cestoda. The definition given of this class by Rolleston is as follows :- "Unisegment-al or spuriously (?) segmented vermes, devoid of organs of special sense and of a digestive tract. There are also organs of adhesion in the shape of chitinoid hooks, suckers or grooves. The nervous system is well developed, and has the form of two or more lateral cords with anterior ganglia. The coelome is represented by irregular channels, the excretory system by longitudinal channels, or by a net-work of vessels both alike furnished with terminal ciliated funnels, and opening externally by one or more pores or a pulsatile vesicle. Hermaphrodite. Male and female genital organs are rarely present in a single set, but more usually repeated many times. Endoparasitic." ("Forms of An. Life",pp.b55-b).

All cestodes possess many characteristics in common. They are parenchymatous animals, the whole body being formed of a hyaline connective tissue of varying firmness, first described by Leuckart in 1862. The worm is really a compound

animal, each segment being a complete individual in itself. All the segments, with the exception of the first, contain similar organs, those nearest the head being immature. The head segment carries the hooklets which vary very much in number, and the suckers, usually four in number, which serve for the fixation of the whole colony, but it does not show any generative organs. Embedded in the body parenchyma, are the various organs of the worm, the muscular, the nervous, and the excretory systems, with the sexual organs. The parenchyma is surrounded by a cuticle which is raised at many points into little hairs. This is specially noticeable on the head segment, where the little projections form the hooklets. The cuticle is elastic and perfectly homogeneous, varying in thickness and firmness in different specimens. It is specially thickened in the bladder-worms of the taenia echinococcus, where it shows a distinct lamination, to be presently described. The cuticle shows vertical striation, caused by thickset pores, which increase the power of absorbtion of the skin, which Leuckart states is the only absorbing organ possessed by Cestodes. (loc.cit.p.285).

The muscular system consists of three sets of fibres, longitudinal, transverse and sagittal, of which the two former are the best marked. (See Fig. 1 & 2). The fibres, some distance from the exterior, are developed in such numbers and are so close to one another, that the whole body parenchyma is divided into inner and outer sheaths. Eschricht called these the "cortical" and "middle" layers. The fibres run sometimes singly and sometimes in bundles, and consist of a

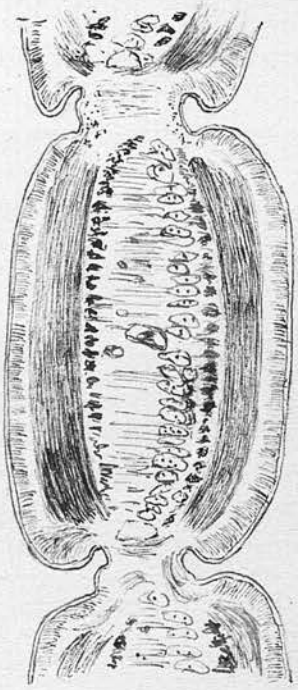


Fig. 1.

Longitudinal section of Taenia saginata, showing muscle layers, middle and cortical.

(After Leuckart)

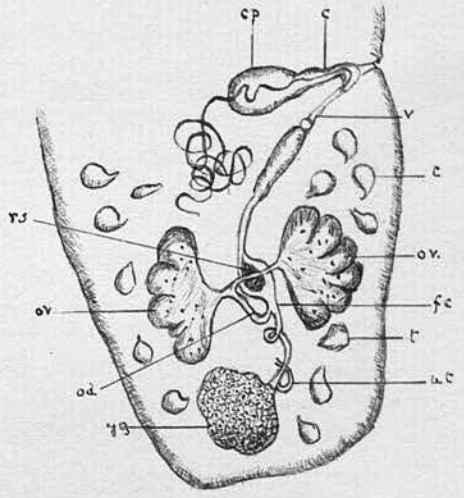


Fig. 3. Reproductive Organs of Taenia Echinococcus. (x80) (After Leuckart). tt, testes; cp, cirrhus pouch; c, penis; ov, ovary; od, oviduct; rs, receptaculum seminis; yg, yolk gland; ut, tube leading to the uterus; fc, fertilising canal; v, vagina.

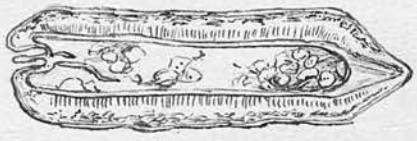


Fig. 2.

Cross section of Taenia Solium, showing middle and cortical layers of muscle, low power (After Leuckart).

perfectly homogeneous, strongly refractive protoplasm, without any nuclei (Leuckart, loc.cit.p.291). In the middle layer lie the generative organs, longitudinal excretory vessels and nerve cords, while the cortical layer contains in addition to the numerous muscular fibres, the "calcareous bodies". These bodies, first described by Pallas and Goeze, are very numerous in bladder-worms specially and are composed mainly of carbonate of lime.(Doyère). In appearance they strongly resemble starch grains, being rounded, solid, laminated concretions. Huxley carefully examined these bodies and their chemical nature. ("Proceed.of Zool.Soc."1852,pt.20.p.113). Von Siebold regarded these structures as skeletal, whereas Claparède took them to be excretions ("Zeitschr.f.wiss,Zool." Bd.9,p.99,1858). At first Leuckart supported Claparède's view, but more recently on further investigation, as been compelled to adopt Von Siebold's. Virchow thought that they arose from connective tissue corpuscles, but Leuckart finds that they"originate as small roundish grains having from the first their chemical and optical properties and obtain to their subsequent size by peripheral growth"(Leuckart, loc.cit.p.284).

The nervous system consists of a well developed central part lying in the head and distinct lateral cords running down the whole length of the chain of segments. The structure of these cords was first identified by Schneider.

The excretory system is made up of two or four longitudinal canals, running the whole length of the worm, united anteriorly by a circularcanal, which is situated under the rostellum. At the posterior end of each segment, there is

a transverse or circular canal, which unites the longitudinal canals. In the latter, immediately above the transverse anastamosis, valves are situated which open towards the ex--terior, so that excretion may escape. These longitudinal canals, when the segments separate, are torn across and the lateral anastamosis becomes a cross cleft. It then assumes a bladder-like form, which receives the contents of the long--itudinal vessels and conducts it to the exterior. The contents of these canals is a clear watery fluid without any granules and said to be composed of substances similar to xanthin and guanin (Sommer). In taenia echinococcus, these vessels seem to have the power of contracting (Von Siebold).

There is no alimentary system in Cestodes, though at first it was supposed that the suckers were mouths leading to the longitudinal canals which were mistaken for alimentary canals. Further, there is no vascular system, the whole nutrition of the animal being affected by a process of osmosis.

The sexual apparatus of taenia echinococcus is distinctive of that worm, therefore it may now be described in particular. Leuckart defines the taenia echinococcus as follows :-
"A tape-worm of comparatively small size and with only three or four joints, of which the last when mature, exceeds all the rest of the body in size. The total length is only a few at most 5 millimetres. The small hooklets have stout root-processes, and are seated on a somewhat swollen rostellum. Their number amounts to usually some 30 or 40"(loc.cit.p.58b). These worms inhabit the small intestine, fixed between the

villi, and are usually found in colonies, not singly. They are so small that a lens is necessary to make them out, when examining the intestine for them. The head is very small, the the transverse diameter being scarsely 0.3 mm, but it has a broninent crown, 0.13 mm broad, surrounding the rostellum. The hooks form two series, from 14 to 25 in each. Those in the inner layer are somewhat the larger, 0.04 to 0.45 mm, (Ceuckart). The claw is slender and rather strongly curved. On the rostellum, behind the hooklets, are situated the four suckers. Behind these, the neck narrows very considerably and passes without any very distinct line of demarcation, into the first segment.

The first segment is about as long as it is broad. The second segment is double the width of the first and four times the length, and in it the male and female generative organs can be distinguished. The third segment is the mature one. It is 2 mm long by 0.6 mm broad, and contains hard shelled eggs, which show the typical six-hooked embryos. According to Kuchenneister, the eggs in each ripe segment number about 500. When the last segment is quite ripe, a new segment ap-pears and the ripe one is cast off. Calcareous bodies are large and numerous in the anterior part of the body, that is in the youngest segments.

The organs of generation consist of 1st. Male, the cirrhus, cirrhus pouch, vas deferens and testes, and 2nd. Female, the vagina, receptaculum seminis, fertilising canal, ovary, yolk gland and uterus. (See Fig.3).

Male organs. The cirrhus pouch is larger in proportion

than in most other cestodes. Its posterior end is club-shaped and reaches the middle line of newly fertilised joints. The cirrhus is freer than usual and lies in the anterior portion of the cirrhus pouch, is hook-shaped and its extremity lies in the anterior end of the vagina. Leuckart has observed it in the act of copulation. The vas deferens is connected with numerous testes by fine efferent canals. Before it reaches the cirrhus pouch, it is much convoluted. The testes, about 60 in number (Leuckart), are scattered through the whole segment.

Female organs. The vagina, whose outer end opens into the sexual cloaca, has a longitudinal enlargement on its course. The posterior end opens into a distinct bladder, the receptaculum seminis. This bladder leads into the fert--ilising canal, which ends in two ducts. One of these passes forwards and divides into two branches, one going to each ovary, the other passes backwards and also divides into two. One branch goes to the yolk gland and the other probably communicates with the uterus. The uterus appears as a wide cavity, but does not develop till after the ovaries and yolk gland have disappeared. Leuckart has never been able to find a shell gland (loc.cit.p.590). The male organs develop first and are mature before the female and, as soon as copu-lation has taken place, begin to atrophy.

Regarding impregnation, Rolleston writes "Self-impregnation appears to be common if not universal, indeed, there does not appear to be the slightest evidence for the fertilisation of one joint by another"("Forms of An.life",p.662). Not only

has Leuckart observed the cirrhus in the vagina of the same point in taenia echinococcus, but P.J.Van Beneden has witnessed the emission of sperm in Phyllobothrium Lactuca. He further remarks "I have seen the same phenomenon of self reproduction in other species"("Vers Cestodes",p.46).

The genital pore is situated on different sides in successive segments in an irregularly alternating manner.

The eggs develop,while still in the uterus, into little round balls, with firm shells, containing a clear globule in which may be seen the six-hooked embryo.

The duration of the life of taenia echinococcus is not definitely known. Probably it is not many months at the outside. A large infection by these worms is said to cause, in the dog, a condition much like hydrophobia. (Leisering).

Development of the Bladder-worm. The development of the bladder-worm has been very fully worked out by Leuckart in the pig and Naunyn in the sheep.

When the eggs are received into the stomach of the intermediate host, the capsules are dissolved and the young embryos liberated. These then bore through the stomach and intestinal walls and find their way into the portal vein. They have been seen in this situation, in certain species of cestodes, by Leuckart (loc.cit.p.399). Kuchenmeister supposed them to find their way into the bile duct and thus pass to the liver. They have never been observed in the bile ducts, however.

When the embryos or proscolices reach a suitable site, they become stationary and begin to develop. They then

consist of a thick, homogeneous, transparent, elastic, capsule which encloses a somewhat coarsely granular contents. Surrounding the whole is a very thin connective tissue cap--sule, which is directly continuous with the connective tissue trabeculae of the organ containing the cyst.

The outside connective tissue capsule is to be regarded as an organ for the protection of the affected part, according to Leuckart (loc.cit.p.19), but is also of importance in the nutrition of the contained parasite.

Leuckart found that the next stage in the development of the bladder-worm was that the central granular portion became clearer than before, due to partial liquefaction; the solid mass thus becomes a true bladder, "which when pricked, voided a portion of its contents in the form of a transparent fluid and then collapsed" (loc.cit.p.596). Below this outer layer, elastic capsule or cuticle, a second layer is developed from "rounded or oval cells, which become angular or elongated in various directions and even distinctly stellate. In this wall, the new membrane is formed consituting the so-called inner membrane or granular layer" (Cobbold, "Parasite of man & animals", p.114). This layer lines the inner surface of the capsule and "is to be regarded as a membraneous expansion of the real body parenchyma (= the germinal membrane of Huxley) (Leuckart, loc.cit.p.597). Huxley terms the elastic capsule the "ectocyst" and the germinal membrane the "endocyst" (Huxley, "On the Anat. & devel. of ech. veterin. from a Zebra," Proc. Zool. Soc. 1852, vol, 20, p.110 et seq.).

Huxley regarded the endocyst as secreted by the embryo.

He says "Bladder-worms ... contained in a strong laminated sac or cyst of apparently chitinous nature, secreted by the parasite" ("Anatomy of Inver. Anim." 1887, ed., p. 186).

This ectocyst may become very thick with the development of the parasite, the laminated appearance showing that it is laid down in layers.

The features which distinguish echinococcus bladders from others are 1. The cuticle is very thick relatively (2 mm in bladders 1 cm in diameter, Leuckart). 2. The absence of a powerful musculature. 3. Slow growth. 4. The late development of heads and vascular system and calcareous corpuscles. 5. The development of brood-capsules, which give origin to several scolices.

The experiments of Krabbe and Jinsen on the lamb, showed that well developed heads may be formed in the interior of the vesicles, within a period of little more than three months. (Cobbold, "Parasites" p. 114). Leuckart states the time as nearly five months (loc. cit. p. 603 et seq.), before the bladder reaches its full development by the production of heads. Sterile hydatids remain throughout their life at an early stage of development (Leuckart, loc. cit. p. 585).

Development and Structure of the Heads. The statement that about five months are required for the development of heads within the bladders, Leuckart qualifies by saying "this is only true of those worms which develop from the six-hooked embryos, for in the daughter bladders and in those budded off from the outside of the mother-cyst, I have sometimes seen brood capsules the size of a hazel nut and less,

Original drawings taken from my own preparations, by means of the camera lucida.

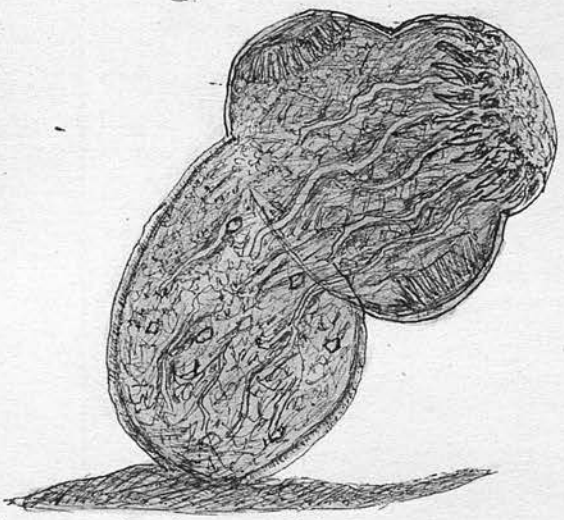
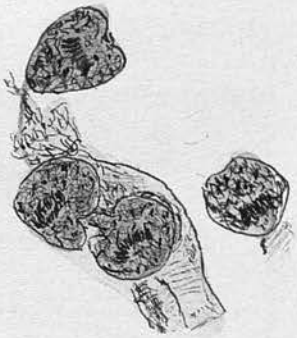


Fig. 10. Scolex, with head everted, showing circle of hooklets, suckers andcanals, also a few of the "calcareous bodies", and attachment. (Drawn with the camera lucida; × 220. Original).

Fig. 11. Scolex with head inverted showing hooklets and three of the four suckers. (× 220 Original)



(× 50)

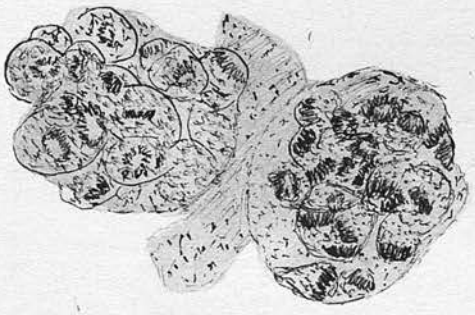
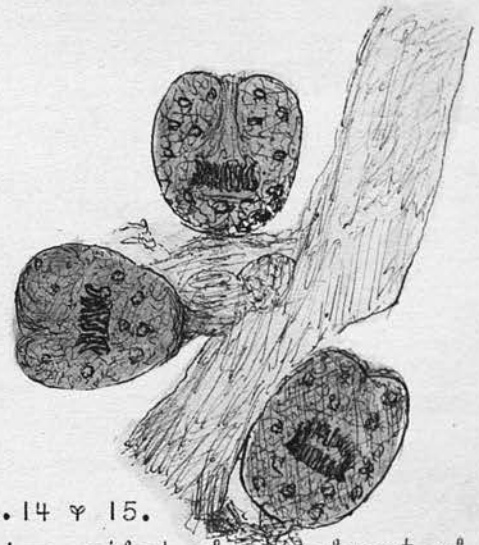


Fig. 12. Two brood capsules attached to the wall of the mother cyst. (Drawn with the camera lucida × 50, Original)



Figs. 14 & 15. Showing method of attachment of scolices to the wall of the parent cyst.

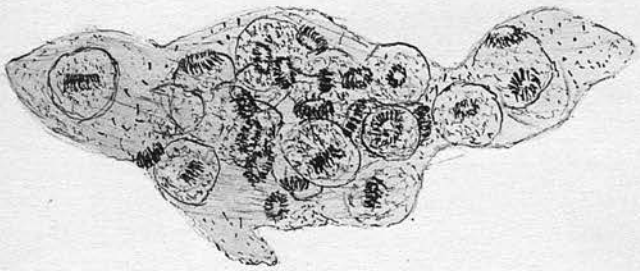


Fig. 13. A Brood capsule, ruptured in mounting, showing 24 heads in the single capsule (Drawn with camera lucida, × 50. Original)

with heads inside them (loc.cit.p.585).

The heads are usually developed within little sacs term-
-ed "brood-capsules". Leuckart says that this is invariably the case, whilst Klebs (quoted by Leuckart) states that he has several times found isolated heads situated directly on the parenchyma, in human hydatids ("Handbuch der path.anat." Bd.2,p.58b). Rolleston follows Leuckart, and says that in in echinococcus "the scolices originate from brood-capsules only"("Forms of An.Life",p.bb4). Perco and Sterling, however, writing more recently (1897), state that they have examined "a specimen which shows four heads shrouting directly from the germinal membrane of an exogenously developed daughter cyst" (Allbutt's"Syst.of Med."Vol.2,p.1107). In one of my own cases, I found two or three isolated scolices, without any trace of brood capsules, adherent to the endocyst of what was apparently a sterile cyst, case no.b(see Figs.10-15).

It is certain then, that the scolices may arise directly from the parenchymatous layer, which was the few held originally by von Siebold, who first discovered the brood-capsules. Von Siebold believed that heads were budded from the walls of the mother-cyst and from the brood-capsules., remained attached for some time, then separated and let a free exist-
-ence. Leuckart maintains that "not only do the echinococcus heads originate without exception, within the brood-capsules, but also in their normal state, the brood-capsules never rupture nor allow the contained heads to escape..... All parts of the cell (mother, brood-capsule and head) are throughout life, in direct continuity with each other"(p.b05).

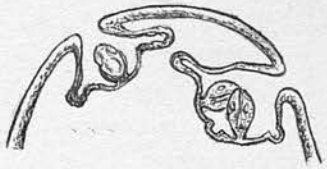


Fig. 4. Diagramatic representation of a proliferating echinococcus. (After Leuckart).

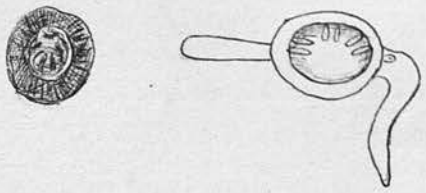


Fig.7. The six-hooked embryo of Taeniae.

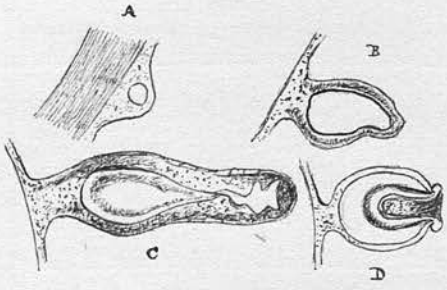


Fig.5. Development of Brood-capsules. (A) of the appended heads; (B) First rudiment of a head; (C) further development; (D) Invagination. (× 90 After Leuckart.).

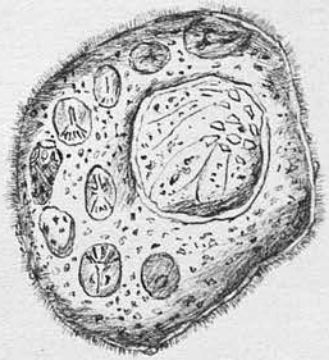


Fig.8. Metamorphosis of an echinococcus head into a bladder in the interior of the brood-capsule. (After Naunyn. × 60).

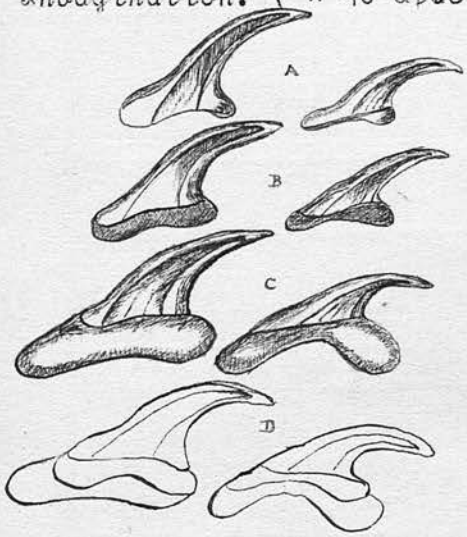


Fig.6. Hooks of echinococcus (× 600) After Leuckart. A. Echinococcus veterinorum; B. T.E. third week; C. T.E. adult; D. outlines of the three forms drawn one within the other to show their gradual changes.

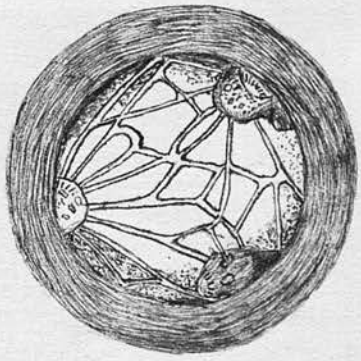


Fig.9. Metamorphosis of the brood-capsules into bladders. (× 90 After Naunyn.)

The brood-capsules arise as minute elevations in certain parts of the germinal or parenchymatous layer, by proliferation of its cells (see Figs. 4 & 5). Within these elevations, a small cavity appears. The cavity grows and becomes lined with a cuticular layer, so that the bud now contains two layers within its walls, the outer being the parenchyma and the inner the cuticular. These hollow buds grow in size, but are easily ruptured or separated from the mother-cyst wall.

In a portion of this capsule, a discoidal thickening takes place, which grows into a club-shaped process, perforated longitudinally by a canal-like continuation of the interior of the brood-capsule (Leuckart, p.607).

This is the rudimentary head which, at this stage, shows marked contractility. At the portion of the process furthest from its attachment, a series of prickles are formed. These eventually disappear with the exception of two layers which form the hooklets. The suckers now also make their appearance, and muscle fibres, vessels and calcareous particles begin to form. The head now becomes invaginated into the brood-capsule. The head or hollow portion bearing the hooklets and suckers may become invaginated into the posterior part and remain so for a long time. Several heads develop in this way in one brood-capsule, so that the latter may come to contain 12 to 15 (Leuckart) or even 22 (Eschricht) heads. I have counted as many as 24 heads in one brood-capsule in one of my specimens (see Fig.13). The size of the fully developed head varies somewhat. When extended they measure about 0.3 mm in length.

In these developed heads, four coiled longitudinal vessels may be seen, which unite into pairs before their entrance into the stalk and are connected below the circlet of hooks, by means of a ring-like anastamosis. The calcareous particles are very distinct. The difference between the hooks of the scolex and those of the mature worm is that the former have no root processes, are smaller and more slender than the latter. (see Fig.b). I have counted the number of hooklets in numer--ous specimens and have found that they vary from 34 to 48. The heads in any one brood-capsule differ in the number of hooks they possess, so that varying numbers do not indicate difference of species, as was once thought to be the case.(Kuchenmeister)

As in the adult worm, the hook are arranged in two rows. As early as 1844, the attachment of the heads by short pedicles was described by Bush ("Transact.of the micros.Soc.", 1844). Erasmus Wilson also described the brood-capsule as a "delicate thin proper membrane by which the echinococci are connected with the internal membrane of the acephalocyst" ("Med.chir. Transact."1845,vol.28,p.21).

Development of the Daughter-bladders. Leuckart maintains that all daughter cysts are formed in the deeper layers of the thick cuticle. "At a definite point, we notice at first between the two lamellae, a little heap of granular substance which presses the adjacent layers apart and after some time becomes surrounded by a special cuticle. By re--peated excretion of cuticular layers, the granular heap be--comes the centre of a system of ever increasing lamellae". The contents of this new bud grow and clear up and pass through

the changes already described as taking place in the parent cyst.

The origin of the granular mass is probably from the parenchymal layer of the mother-cyst. If the bud forces its way outwards, it forms the echinococcus granulosus or simplex of Leuckart, or echinococcus exogena of Kühn, or echinococcus scolicipariens of Kuchenmeister. If the bud forces its way inwards it forms the echinococcus hydatidosus of Leuckart, e. endogena of Kühn, or e. altricipariens of Kuchenmeister. In this latter form, bladders are formed within bladders, and even bladders within these again.

Neunyn's idea was that in the endogenous variety, the daughter-bladders developed by special buddings from the parenchymatous layer of the mother-cyst, or by changes occurring in the brood-capsules (see Fig.8), or in the scolices themselves (see Fig.9). Leuckart also describes a metamorphosis which may take place in the scolices, whereby they may become daughter-bladders. Cobbold inclines to think that the process observed by Leuckart, namely that the daughter-cysts formed between the layers of the mother-cyst alone must be exceptional, and that the usual development of the daughter bladder is by budding from the parenchymatous layer ("Parasites of Man and Animals," p.120).

Echinococcus Multilocularis. Hydatid disease in animals was at one time considered a different disease to that occurring in man, but they have long since been proved to be identical, and the only varieties described are the exogenous and endogenous forms mentioned above, and a peculiar form called Echinococcus Multiloculatis. In this form, a group of small

even very small, bladders lie in considerable numbers near to each other, embedded in a common soft stroma. This form is found almost exclusively in man and with very few exceptions the liver is the organ affected. "On section, numerous small cavities are found, usually irregular in form, separated by a more or less thick connective tissue mass, and with somewhat transparent gelatinous contents" (Leuckart, loc.cit.p.624). This mass can usually be easily extracted, but a number of fine white cords may be seen passing into the adjacent liver substance. These cords are foci for new growth. There is a tendency for the central portion of this mass to break down and when this occurs, it usually causes the death of the host. Therefore, before it was properly identified, the condition was taken for a form of alveolar cancer. Virchow was the first to demonstrate the hydatid nature of this disease ("Verhandl.der Wurzburger phys.med.Gesellsch."Bd.6,1856). Virchow's opinion which has since been proved to be correct, was that the growth was due to external proliferation ofttimes repeated. He thought that the site of the disease was in the lymphatics of the liver. Schroeder von der Kolk and Friedreich believed the original site to be the bile ducts,but Leuckart thinks the primary seat is in the blood-vessels (loc.cit.p.626). The largest bladders are situated in the centre of the mass, those at the periphery being very small (0.1 mm) and very numerous. All the bladders possess the usual structures except that heads do not develop in the majority of the cysts.

The time taken for scolices to develop into mature worms, when received into the stomach of the dog, varies. Von Siebold

found that heads had developed into a 2 or 3 jointed body in from 15 to 20 days. On the 21 st. day the last segment showed clearly the outlines of the sexual apparatus, and on the 27th. day, hard-shelled eggs with embryos were found in the last joint. ("Zeitschrift fur Wissenschaftliche Zoologie", Leipzic 1853, p.409). Van Beneden saw echinococcus heads becoming ripe taeniae within four weeks, while Kuchenmeister discovered no ripe forms for from 8 to 9 weeks. Leuckart found mature worms in seven weeks; Zenker, after 11 weeks, found taeniae developed, but without eggs. Naunyn, Pagenstecher and Nettleship also found mature taeniae 7 weeks after the dogs were fed on echinococci. Cendon gives drawings of taeniae echinococci only 20 days old, which are mature ("Hyd. Dis. of the lung," 1902, p. 127).

METHODS OF INFECTION.

The adult form of Taenia Echinococcus has only been demonstrated in three species of mammals, all belonging to the canine tribe, namely the domestic dog, the wolf (Cobbold "Entozoa", 1864, p.261), and the jackal (Panceri). Australian writers state that it has not been actually found in the dingo, though it is suspected to inhabit the intestine of this animal (Verco and Sterling, Allbutt's "System of Med." vol.2, p.1112). Kuchenmeister asserted that man himself may possibly be the ultimate host of the adult worm of which hydatids are the larval stage, but this surmise has never been substantiated This authority wrote "I should not wander far from the truth if I were to assert that this taenia (Echinococcus Altriciparíens) may probably occur in the human intestines" ("On animal & vegetable parasites of the human body" Kuchenmeister, Sydenham Soc's transl. 1858, vol.1, p.205).

Mammals are almost exclusively the intermediate hosts, though cases have been reported of bladder-worms occurring in birds, viz. the peacock (J.L.Leuckart, vide R.Leuckart's "Parasites" transl. p.586, note), and the turkey (Von Siebold, vide Cobbold's "Entozoa", 1864 p.261). Amongst the most important mammals that are liable to hydatid disease are the sheep, ox and pig. The disease has also been found with varying frequency in the monkey, lemur, deer, camel, giraffe, horse, ass, zebra, kangaroo, squirrel, seal and cat.

In Iceland and Australia, where hydatid disease is commoner by far than in any other country, large numbers of dogs are associated intimately with man and with domestic animals.

The dogs are liable to feed on the offal of dead animals, infected with bladder-worms. The worms develope and the ova are deposited in such situations that they can be easily transferred to the stomach of their intermediate host- to man chiefly through drinking water and uncooked vegetables, to cattle through their drinking water and the herbage which forms their pasturage.

On examination of the statistics shows that the proportion of dogs to men, in Iceland, is according to some writers one to three or five (Krabbe), but probably Neisser is more correct when he states the proportion to be one to eleven. ("Die Echinococcen Krankheit", Berlin 1877, p.39). Not only is the proportion of dogs to men large, but the percentage of dogs affected with taenia echinococcus is large and the relations between man and domestic animals are very intimate. Cobbold, refering to statements of Krabbe's, says "It is sufficient for the purpose of infection, that the natives and their dogs share the same habitation, that the animals are fondly caressed, that they feed off the same plates (which they are often encouraged to lick clean in order that their masters may be spared the trouble of having them washed) and that they sleep with the peasants in the same beds" (Quain's "Dict. of Med." 1886, vol. 3, p. 654). Of these dogs thus fondled, Krabbe estimates that 28 % are infected with taenia echinococcus. ("Recherches helminthologiques en Denmark et en Islande", Copenhagen, 1866, pp. 3 & 11)

In Australia the proportion of registered dogs to men is one to twenty-three, but the registered dogs constitute only

a fraction of the whole number (Graham). Thomas says that the percentage of unregistered dogs infected with taenia echinococcus is as large as 40 %. The ratio of dogs to men is not very important, as this ratio is high in countries not severely affected with hydatid disease; for instance, Ritchie, in the Encyclopoedia Medica (vol.5, p.55) gives the following tables :- "in Pomerania, 1 : 27.8; in France, 1 : 22; in Belgium, 1 : 15," butthe percentage of dogs infected is on the other hand, immensely important.

Cobbold states that of English dogs probably at least 1 % harbour the mature tape-worm("Lancet" 1875, vol. 1, p. 850).

Drawing from a large experience in Australia, Verco and Sterling write "The conditions favourable to the prevalence and spread of hydatid disease appear, therefore, to be the following :- 1. Many dogs infected with taenia echinococcus by which means the supply of ova is kept up. 2. Many animals, such as the domestic herbivora (and in Australia, the kangaroo) capable of serving as the intermediate host of the bladder-worm. 3. Conditions favourable to the entrance of the taenian ova into the alimentary canal, either of man himself or of the ordinary intermediate hosts. 4. Facility of access of dogs to the carcases or the hydatid-containing organs of the intermediate hosts, such as the domestic herbivora, by which means the supply of the taenia echinococcus is kept up." (Allbutt's "Syst. of Med." vol. 2, p. 113).

As to the method in which man actually receives infection, the drinking of impure water is almost entirely to blame. The eating of raw vegetables or fruit grown near the ground

may have a fair share in infection, but it has been almost conclusively proved that the chief source of infection is the drinking water. Other secondary methods of infection have been described. Forinstance, Davies Thomas traced the infection in one case of his, a young child, to the lick of a dog. Again the ova have been supposed to find their way to the lungs through the nares, being blown up with the dust in dust-storms. Dougan Bird thought this method of infection explained the greater proportion of hydatids of the lungs met with in Australia.

With reference to the conditions existing in India, favourable or otherwise, for the spread of the disease in this country, three of the conditions, above quoted from Verco & Sterling, are present in a marked degree. The disease, as will be presently shown, is not uncommon in at least two parts of India. What are the conditions existant, favourable to its spread ? The proportion of dogs to men must be large. I have had no means of finding out the exact proportion, as there is no system of registration except in the large towns, but judging from the number of dogs one sees in every village, the proportion must be as large as 1 : 30. In all village districts, the "pie" dog is very common, nearly every household having its "guardian". These dogs are not fondled in the way described as the custom in Iceland, but they are allowed to sleep on the "charpoys" used by the villagers, when any cots are used at all. Scraps are thrown out to any dogs that happen to be about during a meal, but they are never allowed to eat off the same plate, or to touch

the cloth in which the meal has been wrapped up. The pariah dogs are, however, notoriously filthy feeders, dung or offal of cattle forming a large part of their food. They are always to be found near a slaughter shed and many waste scraps are thrown to them. In spite of these conditions and in spite of the fact that I have had a fairly large number of cases of hydatid disease during the past six years, the percentage of dogs affected with taenia echinococcus must be small. I have examined the intestines of eighteen dogs and have not found one taenia echinococcus at all. Con-ditions must be different in North India, for Dr. Giles, in reply to a letter of Buchanan's, published in the "Indian Med-ical Gazette" Nov. 1896 (p.448), says that he never dissected a pie dog without finding the taenia under consideration. The dogs I have dissected, have nearly all of them, shown specimens of cestodes. Twelve of the 18 have shown specimens of Taenia Cucumerina. In one dog, I count-ed as many as 219 heads of this tape-worm, and many more must have been lost. Many of the dogs have also shown examples of Anklyostoma Duodenale.

Another factor which might assist in the spread of this disease in this country is the jackal. I have tried to obtain specimens for examination, but have not succeeded in doing so. Packs of these animals prowl about the confines of the villages every night and dispose of dung, offal and any scraps that may be thrown out. They even eat dead bodies, human or otherwise, which are usually buried in shallow trenches in some light soil. So that they must be infected with all

sorts of entozoa. In the course of their wanderings round the villages, should they be infected with taenia echinococcus they must deposit dung in such situations that the ova can be easily conveyed to the intestines of intermediate hosts, either human or animal.

We see that there is abundant opportunity for the supply of the adult worms being kept up, but there are also favour--able conditions for the supply of the intermediate hosts. Every village has its flocks of sheep and goats and its herds of cattle, cows and buffalos, which are sent out every morning to pick up what they can in the fields near by. These animals specially the buffalos, are very filthy feeders, so that they run great risks of ingesting eggs or ripe proglottides that may be deposited near at hand. Many of these animals, spec--ially the sheep and goats, are killed for food by certain castes, but should they die, the carcases are usually handed over to the community of outcastes called madigas, the leather workers. It is interesting to note in passing, however, that this class of people does not seem to suffer more from hydatid disease than any other.

Cleghorn says, in writing in the Indian Medical Gazette of March 1871(p.41 etseq), that hydatid disease is very com--mon in animals slaughtered for food. In Mooltan, the slaughter houses were watched and in 2109 animals slaughtered, no less than 899 were affected by hydatid disease (829 times the liver and 726 times the lung was the organ affected). Then in the Inspector General's (I.M.D.) report for 1868-9, the following statement occurs "During three months regular

observation of the animals killed at the Commissariat slaughter-house here (Jallundur), at least 70 % of the beef livers were affected (with hydatids)."

I have watched the animals killed at the slaughter-house here, (Gammalanadugu, Cuddapah District), and have found only one specimen of an echinococcus cyst, which occurred in the liver of a goat. I have had no chance of seeing any beef carcases, but of the 198 sheep examined, 4 showed bladder-worms, in the liver, omentum and lung, and flukes in the liver in 2 (Distomum Hepaticum). The 226 goats examined showed bladderworms in 15 cases and flukes in 5. . The majority of these bladder-worms were found at one season, namelyin the months of September and October, and were the larval stage of Taenia Cucumerina, apparently.

I hear from farmers who have a great deal to do with sheep, that this bladder-worm is very common amongst the sheep and goats, specially in certain districts.

It appears then that, whatever may be the condition of things in the Panjab, in the Cuddapah District, echinococcus cysts are not common.

As regards the customs of the people which favour the incidence of hydatid disease amongst them, the native is not careful about the source of his water supply. In making inquiries, I have endeavoured to obtain information as to what kind of wells the drinking water is usually obtained from, in the various districts. I find that draw-wells are in most constant use, but that the people often obtain their water from other sources. Dogs and

other animals cannot gain access to these draw-wells, but step-wells are also frequently used and into these any an--imals are able to descend. Again, many people draw their water supply from open water-ways, such as canals. One of my own patients, case 3, was in the habit of using canal water. Water from such sources must be badly contaminated and needless to say, the natives of this country never think of boiling their water before use, even the most educated of them. In connection with the the appearance of water, it is well to remember what Cobbold says "open natural waters, however pure and sparkling they may look, are apt to contain hydatid germs in all countries where dogs abound"(Quain's"Dict. of Med."1885,vol.3,p.654).

Reeves, reporting a case from Madras, says "If uncleanliness and close proximity to dogs be the cause of the prevalence of hydatid disease, it is difficult to understand why it is that in India the disease is so uncommon amongst natives, for the same conditions although not so favourable as in Iceland, exist in India for the development of the disease. Why do natives not suffer from the disease at least as much as Englishmen do, for uncleanliness regarding the source of drinking water where dogs abound is supposed to be the great factor in propagating hydatid affections." ("Ind.Med.Gaz."April,1890,p.124). As I shall try to prove later on, the disease is not uncommon amongst natives in at least two districts of India, it is really muchmore common than in Europeans.

We see then that all the conditions favourable to the

spread of hydatid disease quoted above from Verco and Sterling, are present in this country. It is surprising then that the disease is not much more common than it is. The reason for this comparative rarity seems to lie in the great dry--ness of our climate and the force of the sun's rays. Leuckart says "Naubner reports having ineffectually fed a sheep with tape-worm eggs which had been kept dry for fourteen and twenty four days, and I have had a similar ex--perience in which eggs exposed to an August sun had lost their power of germinating after twenty four hours" (Moyle's trans. p.337). If an August sun in Germany had the power of killing tape-worm ova, it seems to me that the tropical sun of India saves it from being infested with hydatid disease to a very large extent. This theory seems to be borne out to some extent by the incidence of the dis-ease in Australia. The parts most seriously affected are those is which the climate is more temperate and moist.

In the cases that have come under our care, all connection with dogs or other domestic animals has been denied by every patient. In many cases there was not even the usual house dog, so that it would seem that the infection must have come solely through the drinking water.

GEOGRAPHICAL DISTRIBUTION.

Hydatid Disease is found in many countries but is only common in a few. In Iceland and in Australia it is met with in a fairly large percentage of cases and in no other country it is as common.

Hirsch, writing in 1885, says about the geographical dis--tribution, "In the form of an endemic malady it occurs, so far as we know at present, in only two countries- in Iceland and in the Australian colony of Victoria. Schleisner first described endemic echinococcus in Iceland ("Island, undersägt fra et laegeridenskab. Synspunkt" Kjobenhaven, 1849, pp.4-16)." (Hirsch's "Geographical and Historical Pathology" New. Syd. Soc. Trans, 1885, p.292).

Iceland. There is a great difference in the statements as to the proportion of cases suffering from hydatid disease to the total sick. For instance, Schleisner states that an eighth of the cases appearing in the medical reports were affected with hydatid disease, whereas the proportion of hydatid cases to the total sick under his own care was one sixth (ref. vide supra) Thorsteinsen, Skaptason, Thoraeson and Hjaltelin concur with this opinion, while Finsen says in his experience only 1 in 26.9 of all cases of disease treated by him were due to hydatid. (Dobell's Reports, 1869, p.287). Galliot states that the in--cidence is about 1 in 30 of the total population ("Bull. gén. de thérap." 1897, Aug. p.97).

Australia. Hirsch states that "first accounts of the disease came from Victoria in 1863 ("Geog. Path." p. vol. 2, p, 293). Hudson, in the "Australian Medical Journal," of April, 1860,

Ralph in the same journal of July, 1863, and Sutherland, in the "Victorian Med. Journal," of February 1863, are among the earliest reporters of such cases. Richardson said, in 1867, that it was exceedingly common in Victoria ("Edin. Med. Jour." Dec. 1867, p. 529). It was stated to be equally common in town and in rural districts. For some years after these reports, the disease seems to have increased rapidly, specially in Victoria (vide "Brit. Med. Jour." 1879, Dec. p. 783; Bird, "Med. Times & Gaz." 1873, Aug. p. 164; Thomas, "Lancet," March 1879, p. 297).

According to Verco and Sterling, the prevalence of the disease varies greatly in different colonies and even in different parts of the same colony. They write "Whether reckoned on the basis of registered deaths from this cause to the total mortality, or on the proportion of admissions of persons suffering from hydatids to the total number of patients received into the various hospitals, the disease is found to be most frequent in South Australia, somewhat less so in Victoria. New South Wales, Tasmania, Western Australia, New Zealand, and Queensland follow with a decreasing ratio in the order named. This statement is based upon returns up to the end of 1894, covering over half a million of admissions to various hospitals.....It is remarkable, however, that no case of the multilocular variety has been recorded in any of these colonies" (Allbutt's "Syst. of Med." vol. 2, p. 1116). Thomas says "Next to Iceland, no part of the world shows so serious a prevalence of the disease as the South-eastern district of South Australia" ("Hydatids," vol. 1, p. 169).

Germany. Leuckart states that the disease is not an un-

-common one in the Central and Northern parts of Germany, specially in Mecklenberg and Pomerania. Peiper's table of the distribution throughout Germany is as follows :-

In Keil	1872-87,	hydatids were found in	0.19%	of total	autopsies.
" Munich	1854-87,	" " " "	0.25%	"	"
" Jena	1866-87,	" " " "	0.84%	"	"
" Greifswald	1862-94,	" " " "	1-50%	"	"
" Rostock	1869-83,	" " " "	2-43%	"	"

The disease is common in Dalmatia, more so than in any of the European countries.

Switzerland. In this country, the common form of hydatid is rare, but the multilocular variety is found as frequently as in any other country, in proportion to the population.

In Russia, the disease is not infrequent (Knoch, "Petersb. med. Zeitschr." 1866, p. 254).

From Norway, only four cases are reported ("Ency. Med." vol. 5p. 54)

Great Britain. Cobbold regarded this disease as not infrequent in this country ("Lancet", 1875, vol. 1, p. 850). He writes "It is not mere guess work when I assert that in the United Kingdom, several hundred deaths occur annually from this cause" (Cobbold's "Parasites", p. 123). But it would seem from hospital reports, that the disease is not so common as Cobbold thought. Thus Murchison states that among 2100 necropsies at the Middlesex hospital, between 1853 and 1863, hydatids were found in 13 cases only ("Diseases of Liv." 3rd. ed. p. 55). In St. Thomas's "Hospital Reports" 1894-98, 15 cases are recorded; in the "Westminster Hospital Reports," 1889-98, 10 cases; in the "Middlesex Hospital Reports," 1893-97, 15 cases.

It would seem that the disease is more common in England than in Scotland. Gairdner writes, when reporting a case of hydatids in the right lung, " the acephalocyst, even in its usual site the liver, would appear to be extremely uncommon in Edinburgh, as among the many thousand dissections I have made during my connection with the Royal Infirmary of Edinburgh, there has not been a single instance of acephalocystic hydatid or echinococcus either in the liver or in any other organ, with the exception of this one" ("Clin. Med." p.431). Again, in 1876, Scott Orr, on searching the records of the Glasgow Royal Infirmary, from its earliest periods, could only find 3 cases of hydatids, one of the mamma and two of the liver ("Glas. Med. Jour." Jan, 1876). In the Royal Infirmahy, Edinburgh, Reports, only 11 cases have occurred in the years 1891-97.

Africa. Bilharz, in 1853, said that the disease was not rare in Egypt ("Zeitschr. fur wissen. Zoolog." 1853, Bd. 4, p.53), though more recent writers declare it to be rare in this country (Madden, "Indian Med. Gaz." 1904, July, p.269). Vital reported it from Algiers in 1874 ("Gaz. méd. de Paris," 1874, pp. 22-3). Clemow says "In Egypt and Algeria, hydatids are not infrequent For the rest of the continent, information on this point seems to be lacking" ("Geography of Disease," 1903, p.572).

Asia. The incidence of the disease in India, I shall treat of fully in the next section, but in most other parts of Asia the disease seems to be very rare. Clemow says " In the Caucasus, the disease is frequently seen; the p.m. records of the Tiflis hospital show that 2 % of all bodies examined have hydatid cysts in the liver..... In China, the disease

must be rare for Dr.Cantlie only saw it once in 40000 cases" (Geog.of Dis."p.572). Cantlie never saw it in a Chinaman, his case was in a European and not of endemic origin.

I have made inquiries of friends practising, the one in Hankow, Central China, and the other in 'Isan Chow, North China. In Hankow, during an experience of 15 years, one case in a Chinaman has been seen, the organ affected being the tibia, and in 'Isan Chow, after during an experience of 9 years, no cases have been seen. The conclusion, therefore, is that the disease is very rare in China.

America. United States and Canada. Clemow says " In Canada and the United States, hydatids are extremely rare. There seems to be no mention of hydatids in Central or South America or the West Indies." (lo.cit.p.572). Osler writes "Statistics of the disease in America have been published by Osler (1882), Sommer (1895-b) and by Lyon (1902), who has collected 241 cases. Of these 136 cases were in foreigners; in 92 the nationality was not stated; 10 were negroes; 2 Canadians; and only one a native American. 56 cases occurred in Manitoba, in which province there is a large settlement of Icelanders, who have brought the disease with them. Only one instance is known in a Canadian-born offspring of an Icelandic emigrant." ("Principles & Practice of Med." 1905 ed.p.34). Osler also states that he has not met with an instance of taenia echinococcus in America, though Curtice, of Washington, found it once in an American dog (lo.cit. p.33).

South America. The disease is said to be common in the Argentine republic, but is rare in other parts. It has been reported from Brazil and Central America ("Brit. Med. Jour." Jan. 7, 1893). The reporter of the last mentioned case knew of no other that had occurred in Central America.

INCIDENCE IN INDIA.

In referring to the literature on the subject of hydatid disease in India, I find that the opinions as to its incidence in this country are very conflicting.

Hirsch says "Besides those two endemic centres (Iceland and Australia), we have accounts of the somewhat frequent occurrence of the parasite in India, a certain proportion of the endemic hepatic abscesses being referable to it (Cleghorn, "Ind.Med.Gaz."March,1871)" ("Hirsch,Geog.& Hist.Path",b.293). In reporting a case to be again referred to, Standage says "We are accustomed to associate these developmental cysts of taenia echinococcus with the upper abdominal zone and in that region, specially in connection with the right lobe of the liver, they are fairly common. I have, myself, recently oper--ated on three in that situation and they must occur pretty frequently in the practice of every Indian surgeon"("Ind.Med. Gaz."1905,b.177-9). Clemow writes(in 1903) "Hydatids are of by no means rare occurrence in many parts of India"("Geog.of Dis".b.572). In answer to one of my letters of inquiry on this subject, I received the following note "In every large abscess of the liver, the question of a possible hydatid has to be borne in mind," but Fayrer, whose experience was mostly gained in India, does not mention hydatid disease as a possible cause of tropical liver abscess when writing on that subject in "Tropical Diseases" (edited by Davidson,b.641 et seq.) neither does Cayley mention it,in the same volume, when dis--cussing the etiology of tropical liver disease (b.612 et seq.). Manson in his book on tropical diseases, also makes no reference to hydatid disease, per se, or as a cause of liver abscess(b.343).

Chevers writes on this subject, "Having proved that taenia echinococcus very frequently occurs in cattle and sheep slaughtered for food in the Panjab, Dr. James Cleghorn has endeavoured to show that a great number of the hepatic abscesses that occur in India may be due to suppurative changes taking place in hydatid cysts previously existing in the liver. Dr. Cleghorn supports his argument very ably .....still I am unable to con--cur in his opinion. Thus he cites statements of Frerich, Morehead and other authorities, to the effect that in India, hydatids rarely occur in man. I and doubtless the large maj--ority of other Indian observers were perfectly familiar with hydatid disease of the liver as it prevails in London. Yet none of us have remarked any resemblance whatever between this condition and the ordinary hepatic abscess in India."("Dis. in India"p.625).

Verco and Sterling write "From the infrequent reference to hydatid disease by Indian medical writers, it would appear to be of not common occurrence in this country, an opinion sup--ported by the result of some inquiries made by the late Dr. Thomas" (Allbutt's"Syst.of Med."vol.2,p.1117). Thomas says "Hydatid disease is not common in India"("Hyd.Dis."vol.1,p.141). Again, in discussing the differential diagnosis of hydatid disease of the liver from tropical abscess, he writes"Echino--coccus disease is so rare in most tropical climates, British India, Ceylon and the Strait Settlements, that error will rarely happen from this cause"(Vol.2,1894,p.6). Ritchie, in discussing the geographical distribution of the disease, says "In South Africa, Egypt, China and India, hydatid disease is rare" ("Ency. Med."vol5,p.54).

Chevers says "The only case with which I am acquainted, in which it appears to be shown that hydatid disease originated in a human subject in India, is that of a low caste (sweeper caste) woman of Bhopal in whose spleen, hydatids were found." (loc.cit.p.29). Buchanan, in reporting a case, considers it interesting on account of the rarity of the disease in India ("Ind.Med.Gaz." 1896,Nov,p.410). In the same journal, in reply to a letter of Buchanan's, Giles states that in the Panjab and the North West Provinces, hydatid disease is"too common to be noteworthy." He says that a carcas of beef is rarely free from cysts in the Panjab and that they are common also in sheep. He has also noticed cysts in sheep in Assam. Buchanan goes on to say that "there can be no doubt then, that the parasite is very prevalent in parts of India. Is it equally common in Bengal ? It probably is. The fact remains, however, be it common or rare in natives of India, cases in them have been very rarely reported on. Much remains yet to be done before the geographical distribution of this disease in India is known" ("Ind. Med.Gaz."1896,p.448). Since this was written there has been no attempt made to collect information on the subject.

I can only find, in literature, a report of 30 cases recorded as occurring in the human subject in India (Thomas accounts for 14,and I have been able to find 20 others, but of these,4 apparently are included in those Thomas mentions) Of these at least 4 are cases in Europeans. The present inquiry has been carried out by means of correspondence with doctors practising in many different parts of India. The results are given in tabular form and represented in the map.

.. In conversations on this subject with officers of the Indian Medical Service in Madras and in Bombay and in various towns of the Madras Presidency, I find that all are agreed that over the Madras Presidency generally and in the Bombay Presid--ency, echinococcus disease es a rare one. Several members of the Staff of the large General Hospital of Madras have in--formed me that almost all of the cases seen at the General Hospital have occurred in patients from the "Ceded Districts." As a result of my inquiries, I find that the majority of the cases of which I have received information, as occurring in this Presidency, have come from these districts and the Mysore. (See the Map accompanying. These two parts are included in the part in the South, colour-washed with red). Again, in answer to inquiries made of officers in Calcutta, I am informed that those on the staff of the hospitals there, state that the disease is a rare one in Bengal, and in the practice of the hospitals in its capital. The same answer has been received from Bombay. In 1892, Childe, in reporting a case of splenic hydatids, found post mortem, remarks that this was the only case of hydatid disease seen in the post mortem room of the J.J.Hospital up till that date ("Brit.Med.Jour."1892,vol.2,p.1431). Several letters received from the Panjab, however, state that the disease is well known in this province, and it will be seen from the following tables, that the majority of cases mentioned have occurred in it. This bears out the statement made by Giles, already quoted. The results can best be shown in tabular form, as particulars vary in different places, specially in the length of the period of the experience of my informants in this country.

MAP OF INDIA, SHOWING THE AREAS IN WHICH HYDATID DISEASE IS MORE COMMONLY FOUND, these areas are marked in red. Only towns in which enquiries have been made are marked, and the number of cases reported from each town are indicated by the figures in brackets after the name of each town.

(after 49)

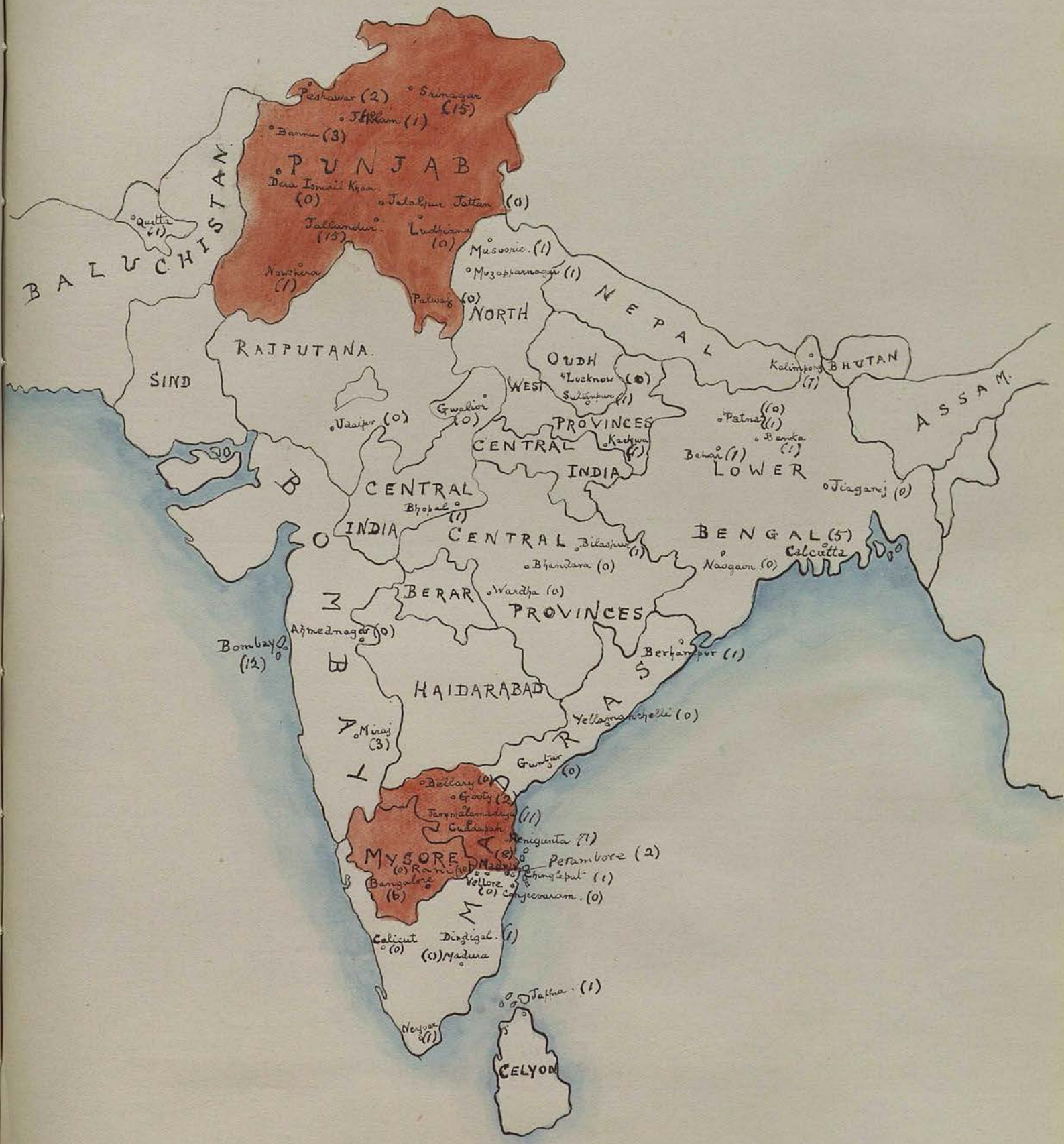


Table 1. Negative replies to inquiries.

Province	Town	District	Length of experience in India of informant
Madras	Ranibet	North Arcot	17 years.
do	Vellore	do	6 do
do	Yellamanchili	Vizagatatam	12 do
do	Madura	Madura	17 do
do	Guntur	Kristna	22 do
do	Conjeevaram	Chingleput	5 do
do	Bellary	Bellary	25 do
do	Calicut	Malabar Coast	10 do
Central Provinces	Bhandara		10 do
Bombay	Ahmednagar		5 do
Lower Bengal	Patna	Behar	10 do
do	Jiaganj	Murshidabad	6 do
Panjab	Palwal		11 do
do	Jalalpur Jattan		4 do
do	Dera Ismail Khan		3 do
Lower Bengal	Naogaon		5 do

Each of the informants in this table state that in the whole of their Indian experience they have never met with a case of hydatid disease, and in almost every case, they have been practising in the same district during the whole of their time in India.

Table 2. Cases reported in literature as occurring in India.

No.	Province	Town	Reference	Nationality of Pt.	Organ affected
1		Mussoorie	"Ind. Med. Gaz." 1869, p. 77*	English	Liver
2	Central India	Bhopal	do 1878, p. 16	Hindu	Spleen
3	(Garden's case)		do 1872, p. 85	do	do
4	(Lyons case)		"Chever's "Dis. in Ind." p. 624	European	Liver
5	(Cowe's Case)		"Annals of Military Surgery," vol. 1 p. 216	Hindu	do
6	North West Prov.	Muzullernagar	"Ind. Med. Gaz." 1881, p. 254	Hindu	Right Kidney
7	Oudh	Sultanpur	" do 1881 p. 254	Mohamedan	Liver
8	Lower Bengal	Calcutta	do 1887, p. 153	English	do
9	Madras	Madras	do 1890, p. 124	Hindu	do
10	Bombay	Bombay	"B. M. J." 1892, vol. 2, p. 1431**	do	Spleen
11	Bhagalpur	Banka	"Ind. Med. Gaz." 1896, p. 410	do	Liver
12	British Baluchistan	Quetta	"B. M. J." 1894, vol. 1, p. 1124	Pathan	Femur
13	Ganjam	Berhampur	"Ind. Med. Gaz." 1899, p. 164	Hindu	Liver
14	Panjab	Jhelum	do 1902, p. 390	do	Fascia of thigh
15	Central Prov.	Bilaspur	"B. M. J." 1903, vol. 1, p. 194-5	Native Christian	Liver
16	Madras	Mysore	"Ind. Med. Gaz," 1905, p. 177-9	Mohamedan	Bladder
17	do Mysore	Bangalore	do do do	Hindu	Orbit
18-20	do	do	do do do	?	Liver
21-30	cited in Thomas's "Hydatids," vol. 1, pp. 141-3				Liver 5; multible 3; brain 2.

* "Ind. Med. Gaz." = Indian Medical Gazette

** "B. M. J." = British Medical Journal.

Table 3. Cases reported in reply to inquiries made and hitherto not recorded.

No.	Province	Town	Nationality or caste	Organ Affected	Period*	Informant
1	Panjab	Jallundur	Informant reports that cases have occurred in all castes	Submaxillary Gland	not stated	Major Smith, I.M.S.
2	do	do		Orbit	do	do
3	do	do		Subrapubic subperitoneal tissue.	do	do
4-15	do	do		Liver	(Information given "many cases in the liver", reckoned as 12. Major Smith	
16	do	Srinagar	Mohamedan	Anterior Triangle of neck	1898-1905	Dr. Neve
17	do	do	do	Eyeball	do	do
18	do	do	do	Parotid Gland	do	do
19-30	do	do	do	Liver	do	do
31-2	do	Peshawar	Hindus	Eyeball	1891-1905	Dr. Lankester
33-5	do	Bannu	do	Orbit	1892-1905	Dr. Pennel.
36	do	Nowshera	do	Liver	not stated	Capt. Venabba, I.M.S.
37	North West Provinces	Kachwa	do	do	1892-1905	Dr. Ashton.
38	Bengal	Kalimpong	Thibetan	do	1900-1905	Dr. Mc. Koig
39	do	not stated	Hindu	Spleen	1902-1905	Capt. McCay, I.M.S. Calcutta
40	do	do	do	Liver, left lobe	do	do
41	do	do	do	Back Muscles	do	do
42	do	Patna	Hindu Nat. Christian	Liver	1899-1905	Miss Dr. Mayne.
43	do	Behar	Mohamedan	Liver	1889-1905	Dr. McPhail.

44	United Prov.	not stated	Native Christian	Liver	1902-1905	Capt. McCay, I.M.S
45	Bombay	Miraj	Sweeper Caste	do	1889-1905	Dr. Manless
46	do	do	Maratta	Liver and Abdomen	do	do
47	do	do	Nat. Xtian.	Liver and Lesser Omentum	do	do
48-59	do	Bombay	Hindus	Liver	1900-1904	Surgeon General's Report.
60	Ceylon	Jaffna	Native	do	1893-1905	Dr. Scott.
61	Travancore	Neyoor	do	do	1893-1905	Dr. Fells
62	Mysore	Bangalore	Vokkaligar	do	1900-1904	Col. Smyth, I.M.S.
63	Madras	Madras	Nat. Xtian.	do	1888-1905	Miss Dr. McPhail
64	do	do	not stated (natives)	do	1895-1904	General Hospital Report (Col. Browning, I.M.S.)
65	do	Dindigul	do	do	do	do
66	do	Perambore	do	Spleen	do	do
67-9	do	Madras	do	Liver	do	do
80	do	do	do	Mesentery	do	do
71	do	do	do	Omentum	do	do
72	do	Chingleput	do	Ilia	do	do
73	do	Perambore	do	Liver	do	do
74	do	Renugunta	do	Omentum	do	do
75-6	do	Cooty (Ceded Districts)	Brahmins	Liver	1893-1905	Dr. Parrie
77	do	Jammalamadugu (Ceded Districts)	Nat. Xtian.	do	1892-1905	our own cases
78	do	do	Merchant	Liver and Peritoneum	do	do

79	Madras	(Cuddapah (Ceded Districts)	Nat.Xtian.	Right Kidney	1893-1905	Our own cases	
80	do	do	do	Pleura	do	do	
81	do	do	do	Muscles of the back	do	do	
82	do	do	Madiga	Posterior triangle of Neck	do	do	
83	do	do	do	Anterior Border of Axilla	do	do	
84	do	do	Bulja	Left Iliac Bone	do	do	
85-b	do	do	Jarmer (Nat.Xtian)	Lachrymal Gland	do	do	
87	do	do	Shebherd	Parotid Gland	do	do	

Period, means the period of time during which the informant has practised in the locality from which information of the cases was sent.

Table 4 Provincial Distribution of the disease, as taken from Tables 2 & 3.

Panjab	37	cases,	Central India	1	case,	Madras Presidency Madras	8	cases
North West Provinces	4	do	British Baluchistan	1	do	Dindigul	1	do
Oudh	1	do	Bombay	1b	do	Perambore	2	do
Bengal	7	do	Ceylon	1	do	Chingleput	1	do
United Provinces	1	do	Travancore	1	do	Ganjam	1	do
Central Provinces	1	do	Mysore	b	do	Ceded Districts	15	do

Places of commonest occurrence, Punjab (37 cases) and Mysore and Ceded Districts (21 cases). In all probability some of the cases entered as from the town of Madras really belong to the Ceded Districts, but were not entered in the reports as such.

Table 6. Regional Incidence. The actual numbers and the per centages of the cases in tables 2 and 3. Total number 117.

Organ	Actual Number		Percentage
Liver, alone		74	63.24 %
Multiple, in liver alone	3		
liver and abdomen	1		
do and lesser omentum	1		
do and peritoneum	1	6	5.12 %
Omentum		2	1.71 %
Mesentery		1	0.85 %
Spleen		5	4.26 %
Right Kidney		2	1.71 %
Bladder		1	0.85 %
Pleura		1	0.85 %
Brain		2	1.71 %
Bones, Left Ilium	1		
Femur	1		
Tibia	1	3	2.56 %
Muscles and Fascia. Muscles of Back	2	2	
Fascia of the thigh		1	
do of the anterior border of axilla		1	
do of posterior triangle of Neck		1	
do of anterior do do		1	
Subpubic subperitoneal tissue		1	7 5.98 %
Orbit		5	4.26 %
Eyeball		3	2.56 %
Lachrymal Gland		2	1.71 %
Parotid Gland		2	1.71 %
Submaxillary Gland		1	0.85 %
		Total	117 cases.

From thesetables the following conclusions may be drawn :-

1. Hydatid disease in India, generally, is rare but not unknown.
2. There are two areas in the country in which the disease may be said to be endemic, it being decidedly common in these areas (vide the red areas in the map). These are :-

   1st. the Panjab, specially in the hilly districts on the North West frontier. Out of the total of 37 cases, 2o came from this part of the province.

   2nd. the Mysore and Ceded Districts. This area is smaller than the Panjab and the period of years within which the cases have occurred is shorter in the case of this area than in the former. Therefore the disease is very possibly as common in the latter as in the former area. Of the 34 cases reported from the Madras Presidency, 21 have come from the Mysore and the Ceded Districts. Of the 8 cases reported from Madras itself, probably some came from these Districts. Again, of these 34 cases, no less than 2b have been seen within the last six years.(1900-1905). In my own experience the disease has been met with 10 times in a total number of 42000 patients.
3. Anumber of cases were reported from Bombay, but I have been unable to ascertain definitely from what town the patients came. 3 cases were reported from the Southern Maratta Country.

The general conclusion is, therefore, that hydatid disease is much more common in India than has hitherto been supposed to be the case. Also, that it is really of frequent occurrence in two areas, where it may be considered to be endemic, namely the Panjab and the Ceded Districts and Mysore.

PATHOLOGY

The structure of the parasite has been fully entered into, I shall, therefore, now deal with the adventitious capsule, the fluid contained within the cyst, and the changes which may occur in the adventitious capsule or in the cyst itself.

The presence of the living parasite creates very little disturbance or inflammatory reaction. If it occurs in some well protected locality, such as in the lungs, bone or brain, the adventitious capsule may be exceedingly thin and ill-defined. The pressure caused by the growing cyst, however, usually evokes some proliferation in the connective tissue around it, so that some distinct formation takes place.

In the younger cysts, the capsule shows both cellular and vascular elements, so that if the ectocyst is separated from it, it bleeds freely (Verco and Sterling). Leuckart thinks that the function of this capsule is partly protective for the host and partly nutritive, through its vascularity, for the parasite (Leuckart's "Parasites of man", Hoyle's trans. p.19). In older living cysts, the capsule is formed of fibres and flattened cells, the latter of which become fused and almost disappear the nearer the inner surface they lie. Verco and Sterling, writing of this capsule, remark "the inner face of a healthy sac is smooth and of a faint pink colour, but we have not been able to satisfy ourselves of the existence of the alledged internal cellular layer. So also, though in young cysts, a certain amount

of vascularity may be noticed, we have not in a large series of cases, observed the varicose condition of the capsular vessels which has been said to give rise to dangerous bleed-ing after the removal of the essential cyst. Indeed, this event, beyond a slight haemorrhagic leakage, has been absent from our experience" (Allbutt's "Syst. of Med." Vol. 2, p. 1119). In none of my cases has there been more than a leakage similar to that referred to by the authors just quoted. Neither have I noticed a varicose condition of the capsule.

The parenchymatous tissues surrounding this adventitious capsule, often atrophy and the connective tissue elements hypertrophy, so that in many situations, specially in the lung, after the removal of the essential cyst, the cavity does not collapse, but remains open and may heal over on its inner surface, or may continue to suppurate, if suppuration has already set in. Cendon, in a monograph on hydatid dis-ease of the lungs, writes "It has hitherto been generally assumed, I think, that the cavity in the lung left after a hydatid cyst has been got rid of, whether piecemeal by ex-pectoration, or wholesale by operation, soon becomes oblit-erated. Now this is not by any means necessarily the case .... I have notes of two cases in which a cavity was found after the complete expulsion of the hydatid membranes by natural efforts: in the first instance, the cavity was healed but not obliterated, in the second it was not even healed" ("Clinic. Lect. on Hydatid Dis. of the Lungs." 1902, p. 68). Cendon goes on to account for the noncollapse of the cavity as follows, "as a hydatid grows, it necessarily causes some

condensation of the surrounding air-cells. At first, its sphere of influence is limited, but gradually it becomes wider. We can imagine that in the immediate neighbourhood of the cyst, the air-cells will be completely closed, whereas there will be only partial compression of those at a greater distance, so that these latter air-cells though not impervious to the entrance of air, will not expand fully. Still increasing in size, the cyst, if centrally situated in the lobe, may cause complete collapse of that lobe, so that it is encased in a shell of condensed lung substance for its adventitious sac"(loc.cit.p.75). This however, is not the usual course, it is usual for the cavity to completely close and healas Lendon again says "Given then that the conditions are favourable for the reexpansion of the lung, we can expect the complete obliteration of the cavity by adhesion of its walls through the agency of effused serum" (loc.cit.p.76). What is true of the lungs is true of hydatid cysts in other organs except that the tendency of the adventitious sac to become obliterated in other organs, is greater than in the case of the lung which is surrounded by a rigid chest wall.

It would seem also that the walls of the sac in the lungs are more vascular than in other situations. Lendon says "The cavity walls are very vascular, and hence we can explain two facts which constitute a difference between pulmonary and hepatic sacs, viz. that in pulmonary there is far less liability for sloughing of the sac to occur after an operation and there is far greater liability to haemorrhage, which is

sometimes of a serious or even fatal character. Such haemorrhage has been demonstrated to proceed from a ruptured varicosé pulmonary vein, as well as from an ulcerated arterial trunk. Pulmonary aneurisms, such as are described as the cause of phthisical haemorrhages, have not hitherto been noticed(inhydatid disease).... There is one point to which I may allude and that is the infrequency with which we meet with degenerative changes in either the hydatids themselves or their adventitious sacs (loc.cit.p.113).

When a growing parasite reaches the surface of the organ in which it is situated and comes to abut on the serous surface,"a fusion of its adventitia with the latter takes place and the combined structure may become further adherent to other neighbouring serous surfaces"(Verco and Sterling).

The rupture of a hydatid cyst in the lungs or elsewhere unless it takes place into a serous cavity, is seldom a fatal occurrence. Long continued suppuration is usually the precursor of death.

Degenerative changes may take place in the adventitious capsule with increasing age. If the cyst remains aseptic, the capsule may undergo simple sclerosis, or the process may go further, lime salts may be laid down and the capsule become calcified, a species of degenerated bone being formed An example of this degeneration was well shown in one of my cases (No.5, described below). This calcification may be very complete. Verco and Sterling mention a case in which it was so complete that a saw was necessary to effect an opening into the cyst.

Apart from these aseptic changes in the capsule, suppuration may take place either spontaneously, the causation being unexplained, or by surgical interference. When suppuration has once set in, it may lead to ulceration, putrefaction with the evolution of gas, or even gangrene. These changes are more liable to occur in cysts situated in abdominal organs and are much rarer in cysts of the lungs, brain or soft parts. Cysts in bone and in the spinal cord if the bone is eroded or otherwise affected, suppurate peculiarly easily, however.

The Fluid contained in the cysts. The fluid evacuated from a living cyst is neutral in reaction and of low specific gravity, from 1002 to 1015. Statements as to the latter differ,, thus Lendon says the specific gravity is 1002 to 1005 or more ("Hydatid Dis.of the Lungs",p.112), Rose and Carless, say "not more than 1007"("Man.of Surgery",1902,p.187) Verco and Sterling say "1006 to 1015"(Allbutt's"Syst.of Med." vol.2,p.1120), Ritchie says "1009 to 1015"("Encyclo.Med."vol.5, p.53), Murchison says "1007 to 1011"("Dis. of the Liver"1885, p.61). It is a limpid (when running), colourless, opalescent (in bulk), transparent fluid, which becomes slightly turbid and faintly offensive in odour after standing a day or two (Lendon). It consists of 97 to 98 or 98 % water, and 1 to 2 % solids (Verco and Sterling). Of the 1 to 2 % solids, the most abundant constituent is common salt, which is found in from 0.5 % to 0.8 %(Ritchie). The fluid gives a copious precipitate with silver nitrate, on account of the large amount of salt present, but no precipitate on boiling.

should any albumen be found, some accidental contamination is to be suspected (Cendon). Of the other solids, succinic acid and inosite are to be found constantly (Ritchie). Heintz, whose observation was confirmed by Naunyn, states that leucin and tyrosin are found in abundance as well as succinic acid, but cysts of the liver were examined in these cases ("Muller's Archiv. f. Anat. und Physiol." 1863, Bd. 9, p. 921). Leuckart believes that the cyst can absorb substances that surround it, which accounts for traces of other matter being found in the fluid. In support of this opinion he states that Lucke found grape sugar in certain bladders. Also Barber and Quecke found uric acid, oxalic acid and calcium triple phos--phate in a case of a kidney hydatid. Leuckart also attrib--utes the presence of cholesterin to the same cause("Parasites of man", Hoyle's trans. p. 631). I have however found cholester-in crystals in great abundance in a case of hydatid disease of bone (see case 10, recorded below). Ritchie commenting on the variable constituents of hydatid fluid, writes "the fluid may contain other constituents owing to the absorptive power of the ectocyst; the fluid of a hydatid of the liver may contain grape-sugar, leucin, tyrosin, cholesterin, cystin and haematoidin, whereas in the kidney, it may contain crys-talsof uric acid, oxalic acid, triple phosphates and other earthy salts"("Encyclop. Med." vol. 5, p. 53). Mourson and Schlag--denhaulfen detected a poisonous ptomaine in the fluid to the presence of which the urticaria, which sometimes occurs, is referable (Mourson "Compt. rendu." 95, p. 791).

Lucke found that the composition of the bladder walls

differed slightly in young and old bladders ("Archiv.f.path. anat." 1870, Bd. 19, p. 189). The analysis is as follows :-

Substance.	Old bladders.	New bladders.
Carbon	45.342 %	44.068 %
Hydrogen	6.544	6.707
Nitrogen	5.1493	5.578
Oxygen	42.9547	44.747

Changes which may take place in the cyst itself. The cyst may spontaneously rupture. Leuckart refers to cracks that sometimes appear in the external surface of the unruptured chitinous ectocyst, as the result of the outer layers being more stretched than the inner. As Lendon remarks, this observation renders spontaneous rupture more intelligible.

Apart from these spontaneous cases, the cyst may be ruptured by some trauma or by aspiration.

The cyst may die spontaneously. The causes of such death are not known but several theories have been put forward, such as the diminishedblood supply, absorption of certain fluids of the body which are inimocal to the life of the cyst, such as bile, serum, urine etc. Leuckart says the cyst may die sooner or later and "the granular cellular layer overlying the bladder, at first not unlike a serous membrane, begins to become loose and turbid. It frequently changes into a creamy or caseous mass accumulating ever more and more round the bladder-worm." The parenchyma of the cyst be--comes softened and undergoes fatty degeneration, and in some parts, is separated from the cuticle. The heads survive free in the fluid, which a little later is exuded and collects round about the bladder-worm and forms a thick mass of a gluey

or honey-like character. The bladder collapses, shrivels, loses its pellucid appearance and becomes an india-rubber-like substance and finally degenerates into an amorphous detritus" (Leuckart, loc.cit.p.650). Verco and Sterling describe distinct stages of retrogression. They say "hydatid cysts that die and undergo spontaneous retrogression, become the subjects of a very constant series of degenerative changes, which may be described in the following stages" (Allbutt's "Syst. of Med." vol.2, p.1121).

1. Stage of turbidity. The fluid of the mother cyst becomes turbid, but the daughter-cysts are clear and there are no changes in the adventitious capsule.

2. Fatty stage. The precipitated proteids are changed into fatty substances. Greater turbidity of the fluid is evident and a little later the liquid contents may assume the consistency of a butter-like smegma. The mother-cyst becomes gelatinous and the daughter-cysts becometurbid.

3. Stage of desiccation. The contents become a putty-like mass. The mother-cyst becomes a mass of gelatiniform shreds. The fatty transformation has extended to the production of crystals such as stearin and cholesterin, and occasionally others, such as Charcot's.

4. Stage of calcareous infiltration. Infiltration of lime salts, which has begun in the adventitious capsule, may extend right through the whole mass. Of the cases under my care, number 5 (recorded below) showed well the second stage mentioned above, but here the calcareous deposit had already begun in the adventitious capsule. In case 10, the third

stage had been reached, the contents of the cyst being tur--bid and much like tapioca pudding, showing cholesterin crystals in great abundance.

As early as 1868, Murchison described several methods of termination of hydatids in the liver ("Clinical Lect.on Dis. of the Liver"1868,p.62 et seq). He refers to spontaneous cure. Of such cases, there can be no doubt, but he says " When a tumour is sufficiently large to give rise to symptoms and be diagnosed, such an event (spontaneous cure) is so rare that it cannot be calculated upon....The parasite may die from calcification of the parent cyst, from inflammatory action lighted up by the entrance of bile or by some other cause, or from secondary vesicles increasing out of all pro--portion to the fluid in which they float...The parent cyst slowly shrivels up and leaves a putty-like mass.

. In the case of liver cysts, virmilion spots of bilirubin may be found here and there, throughout the cyst debris-always in dead cysts. Thomas reports such a case. (Thomas, "Hydatid Disease"1894,vol.2,p.18 et seq.). He also cites Springthorpe's case, in which it was not stated whether the cyst originated in the liver or not, but was supposed not to do so. Springthorpe attributed the presence of bilirubin in his case, to altered blood effusion, and found the pigment in "large quantity"("Austral.Med.Jour."June15th.1886,p.254). Thomas gives the following characteristics of this matter "it is insoluable in water and alcohol, slightly soluable in aether and readily so in chloroform. It is also soluable in potash solution, and this solution, when treated with

hydrochloric acid, yields a green precipitate of biliverdin. With sulphuric acid and sugar it gives a rice purple colour-t ation (Pettenkofer's test for bile salts) . As found in the cysts, it is usually associated with fatty matter..... Microscopically, the flakes are seen to consist of collections of oblique rhombic prisms; it is probable that the presence of such crystals is indicative of a former flow of bile into the sac of the parasite" (loc.cit.p.20). Verco and Sterling report a case in which they found a mass of the crystaline bilirubin weighing 1.13 grammes, with a trace of biliverdin. Many daughter cysts were stained with a simil--ar material. As far as they are aware, this substance has not been found in cysts other than those of the liver, a fact which indicates its biliary origin; further, it only occurs in those cases in which the parasite is dead" (Allbutt's "System of Med." vol.2, p.1122).

Some observers, amongst others Verco and Sterling, have noticed peculiar raised papilloma-like excrescences growing from the walls of otherwise apparently healthy cysts. These appear to be, microscopically, ingrowths of the cuticle which in one case, contained small daughter-cysts. Probably they represent an abortive attempt at endogenous proliferation.

AGE INCIDENCE.

The age of persons attacked by hydatid disease covers a large range. Ceuckart cites a case of Cruveilhier's in which calcified hydatids were found in the liver of a child 12days old. He also refers to Hammer's case, in which labour was obstructed by a large hydatid cyst in the abdomen of the foetus (Hoyle's trans, "Parasites", p.643). Jinsen mentions a case in which a boy of six was treated for hydatids, the first symptoms of which appeared in his first year. Thorstensen reports a case in a child of four, in which the bladder-worm was the size of a child's head. Neisser states that 55 % of all cases of this disease, occur between the ages of 2o and 4o, and gives the following table :- 0 to 10th. year, 4.8 %; 11th. to 20th. year, 13.2 %; 21st. to 30th. year, 30.8 %; 31st. to 40th. year, 24.6 %; 41st. to 50th. year, 15.2 %; 51st. to 60th. year, 6.2 %. The disease has been known to to occur in a patient 81 years of age

The following is the incidence of those cases occurring in India, in which I have been able to obtain information on this point:- 0 to 10th. year, 2; 11th. to 2oth. year, 9 cases; 21st. to 30th. year, 8 cases; 31st. to 40th. year, 20 cases; 41st. to 50th. year, 5 cases; 51st. to 60th. year, 1 case.

From the above it would appear that people at the most active period of life, when they are out and about in the fields more, are more liable to the disease. A reference to my own cases supports this view. 8 of the 11 cases occurred in coolies whose occupation was field work.

SEX INCIDENCE.

The opinions as to the proportions in which the disease occurs in the two sexes vary. In some countries, women are more liable to contract the disease, whilst in others, the men are the more liable to it. Davaine and Peiper state that the sexes are equally affected, whilst Neisser found that out of 669 cases, women were the victims 436 times. According to Schleisner and Finsen, women are more frequently the victims of the disease than men in Iceland. The latter in a later series, gives the proportion as 210 women to 148 men men (Leuckart's "Parasites" p.638). In Australia, men are considerably more frequently affected than women. Verco and Sterling state that out of returns covering 2307 cases of echinococcus disease, in 1300 cases men were the subjects of the disease, while women were affected only 1007 times, a ratio of 100 to 77. Thomas gives a ratio of 100 to 80 ("Hydatids," vol. I, p. 151). Multilocular hydatids occur in women almost exclusively.

I find that, amongst the cases which have come to my notice in India, in which information on this point has been supplied, men have been affected 29 times and women 22, a ratio of about 4 to 3.

The following is a table given by Schleisner.

Age	Male No.	Percentage	Female No.	Percentage
0 - 1	0	0.0	0	0.0
1 - 10	13	7.5	13	6.1
10 - 20	18	10.4	14	6.6
20 - 30	22	12.7	39	17.9
30 - 40	38	22.0	47	22.2
40 - 50	36	20.8	64	30.2
50 - 60	27	15.6	22	10.4
above 60	19	10.9	13	6.1

REGIONAL INCIDENCE.

At different times statistics have been collected with reference to the regional incidence of this disease. Cobbold, in 1875, gives a list of cases he had collected and combares it with a list collected by Davaine ("Traité des Entozoaires," p.375). The lists are as follows :-

Organ affected	Davaine	Cobbold	Total.
Liver	165	161	326
Abdomen, pelvic cavity and spleen	26	45	71
Lungs	40	22	62
Kidneys and bladder	30	23	53
Brain	20	22	42
Bones	17	16	33
Heart and pulmonary vessels	12	13	25
Miscellaneous	63	25	88
Grand Total	373	327	700

In 1877, Neisser gave statistics of 900 cases ("Die Echinococcen Krankheit," Berlin, 1877, pp.25-6). The distribution was as follows :- Liver 451, lung 67, spleen 28, pleura 17, heart and vessels 29, cranial cavity 68, spinal cord 13, kidney 80, pelvis 36, female genitals or mamma 44, bones 28, face orbit or mouth 21, male organs of generation 6, neck 10, omentum 2. In 1894, Davies Thomas gave the following table ("Hydatids," vol.1, p.124-5), based on collection of 1900 cases.

Locality of the Cyst	Number of cases	Percentage of total cases.
1. Organs of the abdominal cavity		
Liver	1084	57.142
Peritoneum, omentum & mesentery	26	1.370
Kidney	90	4.744
Spleen	40	2.108
Stomach	1	.052
"Elsewhere in abdominal cavity	35	1.845
In the true pelvis	40	2.108
Uterus	29	1.528

Ovary	16	.843
Bladder	1	.052
Prostate Gland	1	.052
Total	1363	71.844

2. Organs of the cavity of the Thorax

Lungs	220	11.597
Pleura	19	1.001
Mediastinum	4	.210
Heart and Organs of Circulation	35	1.845
Pericardium	2	.105
"Thorax"	1	.052
Total	281	14.810

3. Connected with the Nervous System

The Brain: its membranes and the cranial cavity	83	4.375
The Spinal Cord: its membranes and the spinal canal	15	.790
Total	98	5.165

4. Organs of Locomotion

Muscles	13	.685
Bones	31	1.634
Total	44	2.319

5. Subcutaneous Cellular Tissue	211	1.107
Abdominal wall	21	1.104
Trunk and limbs	202	1.054
Face, Orbit, Mouth	210	1.107
Neck	10	.527
Total	74	3.899
6. Male Organs of Generation	6	.316
Testes	1	.052
Total	7	.368
7. Female Mamma Total	20	1.054

8 Miscellaneous

Vomited	2	.104
Expectorated	2	.104
Discharged from the intestines	5	.263
In the Common Bile Duct	1	.052
	10	.523

For the list of cases, with the percentages worked out which have come under my notice in India, see page 55.

Liver. From all the lists published, it is clearly evident that the liver is affected in at least half of the total number of cases of hydatid disease, though there is fairly large divergence in the exact percentage in the different lists. The percentage of liver cases in my list is 63.24.

Usually the right lobe is the one affected. From this sit--uation, the peritoneum or pleura may become infected.

Pulmonary. In the tables quoted above, Cobbold gives the incidence of lung hydatids as 8.8 off all cases. Neisser sep--arates the lung from pleural cases and gives the percentage of the former as 7.4. In Australia, lung cases are much more common than in other parts of the world in proportion to the total number of cases. I find that the percentage is very low in Inia, it being 0.85., one case and this a pleural case. For Australasian cases, Thomas finds the percentage is 16.56. ("Hydatid disease",vol.1,p.122).

The pleura may be the primary seat of the disease or it may be secondarily affected from the lungs or the liver. It is very difficult to decide in many cases, whether a case is primarily pleural or lung, so much so that Verco and Sterling write "Very rarely a cyst has been found in the pleural cavity. It is probably impossible to diagnose a parasite so situated from one in the substance of the lung. Nor can its exact site be determined even when one or two ribs have been excised and the hydatid cavity laid open...In fact it is almost certain that many hydatids supposed to be pleural, are really pulmonary

hydatids which have become superficial." (Allbutt's "Syst. of Med." vol.2, p.1138). The only case reported in India is case 8 recorded below.

Kidney. Greig Smith states that "hydatids are found in the kidney six times less frequently than in the liver. In a considerable majority of cases, the left kidney is the organ affected, very rarely are both organs affected at once" ("Abdom. Surgery," p.843). The percentage of cases in which the kidney is the seat of the mischief, to all cases, varies considerably in the lists of different authors. Thus Cobbold gives the per centage as 7.5, whilst Neisser gives it as 8.9, but in that list made up by Mosler and Peiper, it is only 2.8 %.
In the list of Indian cases, the percentage is 1.71. and in the two cases of this list, the organ affected was the right on both occasions.

Spleen. Amongst the 327 cases collected by Cobbold, only 2 were of the spleen. The percentage is much larger in the lists of both Neisser (3.1 %) and Mosler and Peiper. In 1894, Trinkler collected 70 cases occurring "during the previous 17 years" ("Rev. de Chir." 1894, p.107). Thomas gives a percentage of 2.108, whereas the percentage in my list is 4.26).
The remarkable feature of hydatids in the spleen is the small amount of disturbance they cause and the infrequency with which they are diagnosed.

Omentum, Mesentery and Peritoneum. In these situations, the disease is rarely primary. Infection may be due to either tapping or rupture of a liver cyst. Cases are recorded, however, of hydatids affecting the mesentery alone, such as those of

Legge("Trans.Path.Soc."vol.25,p.160),Witzel ("Deutsche Zeitschr. f.Chir."1883), Stanmore Bishop ("Brit.Med.Jour."Nov.18th.1893) and Sterling ("Syst.of Med."Allbutt, vol.2,p.1132).

Cheyne and Burghard state that "hydatid cysts are not very uncommon in the omentum and mesentery, and extraperitoneal cysts have also been found in co nection with the urachus" ("Man.of Surg.Treat."Pt.5,Sect.1,p.415), but as already stated, they are almost always secondary, such as case 2, recorded below.

Pancreas.Hydatids in this organ is a very rare condition. In 1899, Subbotic recorded a case in which it was doubtful if the pancreas was the primary seat of the disease or not ("Wien. Klin.Wchnschr.1899,p.725) and in 1898,Bobroff recorded a case in which treatment was successful ("Khirugya",Jan.1898).

Stomach. Thomas' list includes one case of hydatids in the stomach, but I have not seen the record of another case in this region. It is exceptionally rare a condition.

Retro peritoneal. Two cases of primary retroperitoneal hydatids have been recorded byKorewski ("Berlin klin.Wchschr. 1899,p.725). It is extremely rare.

Bladder and Pelvic Organs. It is very difficult, usually, to decide if,a case is one of primary infection of the bladder or not, but there are a number of undoubtedprimary bladder hydatids on record. In 1893, Mr.Hurry Fenwick, in showing a case at a meeting of the Medical Society, stated that there were "100 cases on record in the last 200 years and of these 52 occurred in the male subject"("Brit.Med.Jour."Dec.18,1893). Since this statement of Fenwick's, a list of "pelvic hydatids" has been published, in which the primary seat of infection is not specified. This list was published by Doleris in 1896.

("La Gynecologie," 1896), and consists of 70 cases, which are made up of a previous list, collected by Villard, of 12 cases, published in 1878; a further list of 18 cases, published in 1885 by Freund; and cases collected by Doleris himself.
In the present list (of Indian cases) one case is found, which was of undoubtedly bladder origin. ("Ind. Med. Gaz." 1905, p. 177).

Cases of primary infection of the various organs of the female pelvis have been recorded. Pean, in 1895, mentions a sace of primary ovarian hydatid (Veit's "Handbook der Gynakologie") Bland Sutton, in his book on "Tumours", refers to a case of primary infection of the Fallopian tube, and Eden notes another of his own in 1904 ("Jour. Obstet. & Gynaec. of the Brit. Emp." July, 1904). Recently, De Vries, of Amsterdam, records a case of primary uterine hydatids and refers to others, of which he considers seven to be genuine. He states that Freund denied that this disease was ever primary in the uterus, but he considers that cases related by Graily, Hewitt, Beigel, Scanger and Treub are undoubtedly primary. (De Vries, "Monat. f. Geb. u. Gyn." March, 1904). Matthews Duncan mentions a case of infection of Douglas's pouch alone ("Clin. Lect." 1889, p. 494).

Male Organs of Generation. In Thomas' list of cases, we find 6 cases of scrotal hydatids recorded. He also cites two cases of cysts in the testicle, one a case of Carry's ("Mémoirs de Chirug. Mititaire" T. 1-3, p. 419), and the other a case reported by Volscher ("Schmidt's Jahrbuch," vol. 51, p. 318).

Bone. Jargett, in 1894, ("Brit. Med. Jour." 1894, vol. 2, Sept. 22). stated that he had examined 17 different cases of hydatids in bone, and that there were about 55 other cases on record.

I have been able to find two cases recorded since that date. Sterling records one in 1896, ("Intercol. Med. Jour. Austral." 1896, p. 33) and Cholmeley one in 1904 ("Brit. Med. Jour." vol. 1 p. 54b) Of the 8 cases mentioned in the present list, 2 have never been recorded, and one was recorded in 1894 in the British Medical Journal, and is therefore probably reckoned in Jargett's list..

Nervous System. Hydatid disease in the nervous system is compatatively rare. In the 700 cases collected by Cobbold, the nervous system was the seat of the affectiin in 42 cases. Neissner's list includes 58 cases of cranial and 13 of spinal hydatids. The percentage of cases in the present list, is small, hydatids of the brain being present in two cases only. Thomas states that in the cases he collected, the ratio of cerebral to cerebellar hydatids is 14 to 1 ("Brit. Med. Jour." 1888, vol. 2, p. 442). With regard to the situation of the cysts, Gowers says "Parasitic cysts may either be hydatid or cysticercus, the former usually single, the latter which are much less common, are multiple. Hydatid tumours have been found outside the dura mater but their usual position is the cerebral hemisphere either in the white substance or within the ventricles" ("Dis. of the Nerv. Syst." 2nd. ed. vol, 2 p. 500).

Heart. In 1897, Roche stated that there were only 45 re-corded cases of hydatid cysts in the heart. ("Quelques loc. rare de l'echinoc.").

Muscle, Subcutaneous Tissue, Fascia and Glands other than alimentary. Ritchie, in the Encyclopoedia Medica, (Vol. 5 p. 61) writes "Hydatid disease in arteries, veins, parotid, thyroid, muscles, subcutaneous tissues and other sites is exceedingly

rare", whereas Cheyne and Burghard , in referring to the question of tumours in muscle, say that hydatid cysts are not at all uncommon, something like 2 % of all cases occurring in muscles (specially those of the lumbar region)." ("Man.of Susg.Pract." Pt.2,p.211), but no lists or references are quoted. In his list, Thomas gives the percentage as .685 of all cases for muscle. In the present list, no less than 12 cases have occurred in muscles,fascia or glands (parotid, submaxillary or lachrymal). giving the very high percentage of 10.25 over all the cases of the disease of which I have been able to obtain information. Several of these cases have occurred in our own practise, and are recorded below.

Orbit. Blaschek, in 1899, only finds 59 cases of echinococcus infection of the orbit on record ("Wien.klin.Wchnschr.1899,p.126). In the present list, if cases of eyeball and of orbit infection be reckoned together, the large percentage of 6.83 is shown). A case of hydatid disease of the retina has been recently recorded (Wood"Lancet",Nov.18th.,1905).

Multiple Hydatids. Thomas gives a long list of multiple hydatids ("HydaDis."vol.1,p.121). And other numerous instances are on record. Writing about this condition, Ritchie says "Multiple echinococci are referred to infection by numerous embryos at one time, to repeated infection, or lastly, and specially in the case of the peritoneum, to development from daughter-bladders, brood capsules or scolices, which have escaped from the parent cyst in consequence of tapping or rubture" ("Encyclo.Med."Vol.5,p.56). Westhoff thinks that the reason for the infrequency of multiple hydatids is that the gastric juice acts delitiously on the embryos ("Brit.Med.Jour." 1892vol,2,epit.p.

SYMPTOMATOLOGY and PROGNOSIS.

With regard to the general symptoms of hydatid disease, there is not much to be said. Murchison remarks about this subject, "The latent character of hydatid disease is one of its chief characteristics. It often attains a great size without causing any pain or uneasiness, and often indeed without the patient being aware of its existence..... There is in like manner an absence of all constitutional symptoms .....There is no pyrexia or impairment of the general health, and the chief symptoms are those due to pressure on adjoin--ing organs and interference with their functions" ("Dis. of the Liver," 1868, p.58)

Hydatid cysts are characterised by the slow and as a rule steady, painless growth of a cyst forming a globular, non-tender, elastic, fluctuating swelling, not accompanied by any fever or cachexia. Occasionally there may be severe pain. This is usually accidental, and due to the irritation of a nerve-twig by the enlarging capsule (Verco and Sterling) Sometimes the pain may be due to secondary inflammation, as that of a peritonitis or a pleurisy.

The earliest sign is usually a feeling of weight and fulness, with perhaps an interference of certain movements of the body. If the cyst reaches a palpable surface, dis--tinct fluctuatian may be made out, though this is not in-variable, as the tumour may simply give a tense elastic feel. In some cases the "hydatid thrill" or "fremitus," first described by Briancon and afterwards by Piorry, which has been supposed to be due to the presence of daughter

cysts, may be made out. Regarding this phenomenon, Thomas states "1. that it is an uncommon sign in hydatid cysts. 2. It has been noticed in other conditions than echinococcus cysts (such as a tense parovarian, ascitic fluid collections etc.). 3. That it is hardly conceivable that daughter cysts can be concerned in the production of this sign, for when present they are not capable of much movement in the tense mother-cyst; moreover, the phenomenon has been observed where no daughter cysts existed in the fluid of the tumour. As a physical sign, this symptom possesses no greater diag--nostic value than does a "cracked-pot" percussion note in phthisis" (Thomas, "Hydatid Dis." 1894, Vol. 2, p. 5) In only one of my own cases has this fremitus been present, case 3, whereas I have noticed it in a case of ascites accompanying a compound ovarian cyst, one locule of which had ruptured.

"Symptoms due to the interference with the function of an organ, vary inversely as the ability of the organ to expand." (Verco and Sterling, Allbutt's "Syst. of Med." vol. 2, p. 1125). If an organ is capable of free expansion, then there is little interference with its functions, such as in the case of the kidney. If on the other hand the organ cannot expand, there is marked interference with its functions, and symptoms usually appear fairly early, as in the case of brain, bone and pulmonary hydatids.

If a hydatid cyst should rapture or the contained fluid escape by any chance into the tissues generally, urticaria is a very constant symptom. This is usually general and lasts for one or two days. It is probably due either to the

absorption of a ptomaine contained in the fluid (Mourson and Schlagenhauffen) or of a toxalbumin (Viron, "Archiv. de med. experim." 1892, p. 135). There is at the same time a great fall in the blood-pressure of the systemic arteries (Roy). A similar urticarial rash is found in other parasitic dis-eases. For instance, one of the most common symptoms of a quinea-worm about to force its way to the surface of the skin is a profuse urticarial rash, lasting one day or perhaps a little longer. This symptom, of a quinea-worm, is not gen-erally referred to in text-books on tropical diseases, though Duke mentions it in an article in the Indian Medical Gazette. (December, 1893).

Frequently on the bursting of a hydatid cyst, in addition to this urticaria, there is profound shock. In a case report-ed by Mansell Moullin, in a boy of 19 years of age, there was a history of a rupture of a cyst, followed by urticaria and slight shock. Sometime after, an operation was perform-ed, which was followed by the bursting of an other into the cavity of the first, which caused almost fatal shock. ("Brit. Med. Jour.", 1892, vol. I, p. 227). Previous to this Thomas had reported a case at a meeting of the South Australian Branch of the British Medical Association, in which severe shock and erythema ensued after the withdrawal of three ounces of fluid from a cyst ("Brit. Med. Jour." 1887, vol. I, p. 1101). He also notes two other cases in which aspiration of a cyst caused shock and death and a third case of death was reported by another speaker, the cyst being a pulmonary one, which was aspirated. Hayward, at the same meeting, mentioned

other cases of shock following aspiration of a cyst. It was thought that the administration of chloroform would di diminish this symptom (Gardener). Thomas accounted for this symptom by the reflex inhibition of the heart through the sympathetic nerves supplying the liver, spleen etc.

If the cyst should have suppurated, constitutional symptoms are set up. The health becomes undermined, nutrition suffers, circulation is disturbed, amyloid disease is set up, and a condition of marasmus supervenes with, finally, death from exhaustion.

Further symptoms and physical signs will be dealt with in the consideration of the individual organs.

As regards the general prognosis, Cobbold reiterated the statement "You may be well assured, I understate the fatal capabilities of echinococcus disease, when I express the conviction that hydatids prove fatal to 25 % of all the human victims they attack" (Lancet, 1875, vol. 1 p. 850, Quain's "Dict. of Med." 1886, vol. 3, p. 655, Cobbold's "Parasites of Man and Animals," p. 122). Under present day methods, however, this percentage is probably much too large. The prognosis depends largely on the organ attacked, therefore it will be treatedof along with the symptomatology of cysts in the individual organs. It is well to state, however, that in the multilocular variety of hydatids the prognosis is specially bad, the majority of such cases proving fatal.

Symptomatology of Hydatid Cysts in the Various Organs.

Liver. The symptoms of a liver hydatid are very indefinite. A slow-growing, painless, non-tender swelling usually enlarg-

-ing the liver in some particular direction and not uniform-
-ly, causing, when large, a sense of weight and distension.
There may be pain referred to the right shoulder, similar
to that associated with tropical abscess of the liver. Very
rarely is there any jaundice or ascites, unless suppuration
has set in, when the former is not infrequently present.
There is very rarely any interference with the function of
the alimentary canal, even when the tumour has reached a
very large size. The physical signs vary according to the
size and situation of the cyst. The surface of the tumour
is usually smooth, with a tense elastic feel and even when
near enough to the surface to be palpable, fluctuation is
rare, the cyst being too tense (Thomas). In cases of
multiple cyst, there may be an irregularity of the surface
simulating cancer. If there be calcareous degeneration of
the capsule or cyst, it may be very difficult to distinguish
the case from one of gall-stones, on the one hand, and cancer
on the other, there being a tense elastic tumour with an ir-
-regular surface, part of which is as hard as bone (vide
case 5 recorded below). If the cyst has grown upwards, it
will cause dullness of the side of the chest into which it
is projecting, with probably bulging of the costal arch and
possibly of the intercostal spaces. A cyst growing in
the liver may cause various displacements of the viscera.
The liver itself, may be displaced upwards or downwards or
to the left side (vide Budd's case, for an example of the
latter, "Lancet", 1859, vol. 1, p. 6). The displacement upwards
may be so great that the lung is compressed. A case is on

record in which the right lung was reduced to the size of a hen's egg, on account of the pressure of a liver hydatid(Tommassini's case, cited by Thomas,"Hydatid Dis." vol.2,1894 p.2.). The heart may be pushed to the left, or it may be pushed against the anterior wall of the chest, which is rather a characteristic displacement. A cyst in either lobe may cause this displacement.

As already stated, rarely is it that the functions of the alimentary canal are interfered with, but the stomach may be displaced as far as the pubis ("Brit.Med.Jour."1859 p.780), and a case has been recorded of obstruction of the duodenum by a hydatid cyst of the liver (Crowther,"Austral. Med.Jour." Dec.1880,p.546).

Pressure may be exerted on the kidney or ureter, causing a hydronephrosis, or even degeneration of the kidney substance. (Murchison,"Dis. of Liver",1868,p.100).
A case of pressure on the inferior vena cava has been report--ed, by Hamilton("Brit.Med.Jour."Dec.14,1872). and one of pressure on the portal vein,by Barker ("Path.Soc.Trans."vol.7 p.225). All these conditions are very rare, however.

A hydatid cyst may rupture in various directions.
1. Into the lung or pleural cavity, the most common direction. If rupture has taken place into the pleural cavity, it usual--ly proves fatal at an early date,but if the rupture be into the bronchus (lung), death usually takes place from gangrene and exhaustion, the immediate prognosis not being so grave.
2. Into the pericardium. Two cases of rupture in this dir-ection have been reported by Davaine ("Traite des Entozoaires"p.400)

and Wunderlich ("Med.Times & Gaz."Nov,12th.,1859,p.488)
The result is always fatal, but fortunately rupture in this direction is very rare.

3 Into the peritoneum, a fatal peritonitis almost always being set up. This direction is not so uncommon a one for rupture.

4. Through the abdominal parietes or extraperitoneal tissues as in Treves' case ("Brit.Med.Jour."1887,vol.2,p.1333).

5. Into the stomach or intestines. Davaine collected eleven cases in which rupture took place into the stomach, with six fatalities, and fifteen cases of rupture into the intestine with only one fatality.

6. Into the biliary passages, setting up biliary colic and jaundice, of which the latter may prove fatal. Rupture in this direction may be recovered from however (vide Black's case, a male of 19."Brit.Med.Jour."1887, vol.2, p. 124).

7. Into the inferior vena cava. Murchison cites three such cases reported by Frerichs ("Dis. of Liver",1868,pp.69&70).

Diagnosis. The differential diagnosis of hydatids de-
-pends on their situation. A. When situated near the surface of the liver, they must be distinguished from :-

1. Subphrenic or tropical abscess. The previous history will be of great value. A history of dysentery or malarial fever, with pyrexia, rigors, pain in and tenderness over the liver point to an abscess, though if the hydatid cyst should have suppurated, the symptoms will be identical in the two cases. The treatment is the same in both conditions however, so that doubt as to the parasitic origin or not of

the abscess, is of no practical importance.

2. Echinococcus cyst of the base of the right lung. In many instances impossible to distinguish between hydatids of the base of the right lung and those of the convexity of the liver. Cough, specially with sputum streaked with blood or regular haemoptosis, will be in favour of the pulmonary situation of the cyst.

3 Pleuritic effusion. In this condition, there is usually a history of an acute onset, with pyrexia and pain. After the effusion has taken place, there is usually more displace--ment of the heart, at any rate in a lateral direction, than in a hydatid cyst. Other physical signs may be identically the same in both conditions. The aspiration of serous on the one hand and hydatid fluid on the other, would at once clear up the diagnosis.

B. When situated on the lower surface of the liver, echin--ococcus cysts must be distinguished from :- 1.Cancer. The history of more rapid growth, the cachexia, pain and tender--ness, frequent jaundice, the nodular surface of the liver all point to cancer. The diagnosis of the multilocular var--iety of hydatids from cancer is however, very difficult and such hydatids have almost invariably been diagnosed as cancer.

2. Cardaceous and waxy liver. The history, with a thorough examination of other organs will usually clear up the diag--nosis between these conditions. There is not much danger of the two being mistaken.

3. Tropical Abscess. In the case of a suppurating cyst, the diagnosis between these two conditions is almost impossible,

unless there be a clear history of dysentery or malaria. The treatment being the same in the two conditions lessens the practical importance of a differential diagnosis.

4. Cirrhosis of the liver. In this condition, there is us--ually a history of alcoholism and gastric disturbance. The conditions are not very likely to be confounded.

5. Distended gall-bladder. A pedunculated cyst such as that described in Jacomet ("Bull.de la Soc.Anat.de Paris," July 1898) may very much resemble a distended gall-bladder. In such a case aspiration and examination of the fluid withdrawn should be done, when the diagnosis will be cleared up.

6. Hydronephrosis and renal cysts. On deep palpation, the fingers can usually be inserted above a renal tumour and there is usually less movement with respiration in such a case. The tumour seems, also, to be situated more deeply. Sudden diminution in the size of the tumour, with the passage of a large quantity of urine, would indicate a renal condition. The situation of the tumour will, on careful examination, usually be sufficient for a differential diagnosis.

7. Ovarian tumour. The history of the site of origin and the course of growthof the tumour is of great importance. If this cannot be obtained, the two conditions are very sim--ilar. Even by able and experienced men, mistakes in diag--nosis have been made. Vaginal examination will be of great value , as the uterus is more distinctly felt in the case of a hydatid than in an ovarian tumour, hydatid cysts of the liver rarely entering the pelvis sufficiently to displace the uterus to any extent.

8. Ascites. Commonly, there is no difficulty in the dif-
-ferential diagnosis of these two conditions. In the case of hydatid cysts, resonance is present in the flanks almost invariably. Thomas records a case in which the diagnosis was difficult owing to the enormous distension of the abdomen by the cyst ("Austral.Med.Gaz."vol.9,p.72). Examination of the fluid withdrawn by an exploratory needle is necessary in such a case.

9. Phantom tumour. Such tumours disappear on the administration of an anaesthetic.

Prognosis. This largely depends on the methods of treat-
-ment. Thomas gives statistics which show that by Lindemann's method, in a series of 68 cases, the percentage of deaths was 10.29, while the recoveries were 89.71 % . By modern methods this mortality should not be exceeded. The prognosis is, therefore, favourable. In the multilocular variety the prognosis is very bad, such cases almost always prove fatal. If the cyst has suppurated, the prognosis is also more grave.

Hydatid Disease of the lung. Lendon, in his monograph on hydatid disease of the lung, divides up the progress of this condition into various stages ("Clin.Lect.on Hydatid Dis.of the Lung",1902,pp.6 et seq.) These stages are as follows:-
A. The unruptured cyst. Stage 1. Latency- marked by absence of symptoms, or by indecisive symptoms, ending in retrograde changes, or going on to the next stage. From notes of cases of echinococcus disease found post mortem and not suspected during life, the author draws the following conclusions :-

1. A cyst may exist in the lung and attain to the size of an orange, to the diameter of three inches, or to the capacity of a pint, without giving rise to symptoms which attract attention. 2. Such a cyst may exist in either lung or in either lobe, but is more frequent in the lower lobes. 3. Absence of physical signs does not depend on the development of the cyst in some deeply situate position, but 4. its presence is frequently overshadowed by some more easily recognised cyst of abdominal origin. 5. There may be more than one latent cyst in the lungs. 6. The cyst may either be living or may have died and undergone degenerative or retrogressive changes. Stage 2. Suspected hydatid cyst. Symptoms which lead to this suspicion are 1. Cough, which is a constant and early sign. It may have a croupy or clangy character at times, possibly from pressure on the recurrent laryngeal nerve. (Thomas). The ordinary dry cough is probably due to irritation of the peripheral terminations of the vagus nerve in the lung. 2. Pain is sometimes present, though it is not very constant or very early in appearance, and usually indicates pleurisy. There is frequently a feeling of some-thing abnormal in the chest. 3. Haemoptosis. This is of frequent occurrence and is important, as it draws attention to the presence of some disease more effectually than any o other sign. During this stage, the bleeding is usually slight in amount "ranging from a mere streak of blood in some frothy sputa, to two ounces or a wineglassful." (Lendon). The haemoptosis may be repeated and is commonly bright in appearance. 4. Expectoration of phlegm. There is as a rule,

not much sputum. 5. Dyspnoea. is frequently present in more or less marked degree. This may occasionally be paroxysmal. In one case, cited by Thomas, the dyspnoea was severe enough to produce death although the cyst had not been ruptured. (Allen, "Austral. Med. Jour." March, 1881). The patient, a man of 50, died suddenly while coughing. b. Fever and malaise are not often present. Should they be so, some complication is to be suspected. Together with these symptoms, certain physical signs are often met with. A group of such signs was described by Dougan Bird as early as 1871 ("Austral. Med. Jour." March 1871, p. 73). They are as follows, more or less deficiency of expansion of the diseased site, a tolerably sharply defined area of absolute dulness of limited extent, with absence of respiratory murmur, and loss of vocal fremitus over the dull region, now and then friction is heard over the space affected. Beyond the dull area, the normal conditions as to percussion and auscultation prevail. The physical signs are then enlargement of the chest. This sign is more specially noticeable in children. With this enlargement, there may be obliteration of the intercostal spaces. 2. Impairment of the movements of the chest. The difference between the two sides may be more pronounced during ordinary quiet respiration than on deep inspiration. (Lendon). 3. Vocal fremitus is not much help in children, but in adults, its absence is important to note. The peculiar "hydatid fremitus" is very rare in pulmonary cysts. 4. Percussion resonance. There may be absolute dulness, like that of a pleural effusion rather than a pneu-

-monic consolidation. This dulness is not altered by the position of the patient. The precise area and its shape is of great value in the diagnosis, as the dulness does not conform to the usual position of pleuritic effusion. There may be a "boxy" character in the percussion note and not complete dulness. Thomas lays much stress on the "skodiac" percussion note ("Hydatid Dis." vol.2, p.55 & 56) 5. Vocal re-sonance and respiratory murmur are entirely absent over the absolutely dull area. Outside this area, respiration may be audible but rarely has the tubular quality met with in pleural effusions.

Pressure signs are met with in unruptured pulmonary cysts. The liver may be displaced downwards or the heart's position altered in various directions. The displacement of the heart is never great in a lateral direction, if there be no pleural complication, even in the case of a cyst situated in the base of the lungs (Condon). If the heart is displaced, it is usually flattened against the anterior chest wall, so that the area over which the apex-beat may be felt is much increased (Thomas, "Hydatid Dis." vol.2, p.57) and a murmur may be produced (Condon, "Hyd. Dis. in the Lungs," p.63). Rare cases of the pressure of cysts causing oedema (Williams, "Aust. Med. Jour." 1881, p.267) and of cysts simulating aortic aneurism (Allen, "Austral. Med. Jour." 1881, p.104) have been recorded.

B. The rupture of the cyst. Stage 3. Rupture and expulsion of the contents of the cyst; it may cause death from drowning or suffocation from hydatid membrane, or it may end in quiescence. The symptoms of rupture vary very much in urgency. They may be so slight as to pass unnoticed;

in one of Lendon's cases rupture was suspected because the patient complained that after coughing the sputum tasted like "canned-herrings" ("Hyd. Dis. of Lungs", p.36). From this slight condition all grades of symptoms may occur, to severe attacks of orthopnoea with violent coughing and bringing up of much watery fluid. The cough may be incessant for hours at a time, returning after longer or shorter intervals. These paroxysms are of a very alarming nature. Death may take place from flooding of the lungs and "drowning" (Thomas "Austral. Med. Gaz." Dec. 15th. 1889, p.73), or by blocking of the sound bronchus by hydatid membrane (Broadbent, "Lancet" 1878, vol.2, p.575). ,, With rupture there is usually a "salty", "disagreeable" or "abominable" taste in the sputum, the evac--uation of some amount of frothy, watery fluid, tinged with blood or with a moderate amount of haemorrhage.

Stage 4. Period of quiescence. This stage lasts from the time the cyst ruptures to the time that expectoration of the membrane begins and during this period there may be no symp--toms at all though usually the patient does not "feel quite well". Stage 5. Expectoration of the cyst, prior to suppuration. In this stage, pieces of membrane are brought up from time to time which indicate the nature of the disease. The physical signs are usually indefinite and seldom indicate the existence of a large cavity.

Stage 6. Suppuration of the sac. The symptoms of this stage are practically those of phthisis, from which condit--ion it is very difficult to diagnose if the cyst is at the apex of the lung. The cough is incessant and disturbs the

the patient's rest at night. Expectoration is profuse, purulent and foetid, with often the characteristic taste which makes the diagnosis clear. Hectic fever is usually present with occasional rigors and night sweats. There is emaciation with clubbed finger-nails and incurved nails and anaemia. Dyspnoea and cyanosis may be marked and there may be huskiness in the voice or even aphonia. Haemorrhage is a frequent symptom, varying very much in amount. The discovery of hooklets and pieces of membrane in the sputum will make the diagnosis plain, though tubercle bacilli may also be found, as the two disease often exist together.
The physical signs may be more idstinctive. On examining the chest, it is found to be of good shape. In children, whose chest wall has not yet become rigid, there may be a marked local bulging. Over the site of the hydatid, there is a deficiency of movement, of vocal fremitus and of percus-sion resonance. There may be complete dulness with a "cracked-pot" note. The breathing is tubular or amphoric, with marked bectoriloquy and, frequently, moist rales.
Change of posture may cause an alteration in the physical signs.

Diagnosis. Hydatids of the lungs have to be differenti-ated from phthisis, pleural effusion, pneumothorax, cancer, sarcoma, mediastinal tumours and aneurism. Of these, the first two are the chief conditions which lead to a mis-taken diagnosis. The other contitions are so rarely likely to be mistaken for hydatids that they need not be considered. The history of the case will usually clear up the diagnosis. In doubtful cases, exploratory puncture should be performed.

When this is resorted to, however, care should be taken to have instruments ready to proceed with operation, should the case prove to be one of hydatid cyst. 1. The diagnosis of an unruptured cyst from an early phthisis may present dilliculties. The general good health, the absence of py--rexia, the sharply defined dulness, respiratory silence, and absence of rales are usually sullicient to enable the diagnosis of hydatid cyst to be made. "The age, sex, occup--ation, nationality, residence and lamily history of the patient will also help in the diagnosis" (Cendon).
2. Diagnosis from pleural ellusion. The history taken along with the symptoms and physical signs already described, en--ables us to make a diagnosis with certainty as a rule. Exploratory puncture and examination of the fluid withdrawn may be necessary in some cases. 3. O diagnosis between a ruptured cyst and phthisis is often very difficult. Here again, a careful consideration of the history, the con--dition of the patient, the physical signs and the repeated microscopical examination of the sputum will lead to a correct diagnosis

Prognosis. 1. Of an unruptured cyst. The prognosis is good if operation is submitted to, but it is bad if it is left alone. 2. Of a rupture into a bronchus. The immed--iate prognosis is not bad, as rupture rarely causes death. Out of 182 cases collected by Thomas, which were not operated on, 63 recovered, 25 died and in 14 cases the result was not recorded. ("Hydatid Dis." vol. 2, p. 45). The ultimate prog--nosis, also is fairly good if operation be submitted to.

3. Rupture into the pleural cavity. The prognosis in this condition is bad, as this accident is almost always fatal, unless the case is immediately operated on. 4. After rupture. If operation is submitted to the prognosis is good, unless the cyst be a very large one and the case far advanced. If no operation is allowed, however, the case usually ends fatally, amyloid disease being set up.

Hydatids of the Pleura. It is possible to diagnose a cyst of the pleural cavity as distinct from one of the lungs. In such a case the bulging of the intercostal spaces and a more decided local bulging, together with the presence possibly, of hydatid fremitus, may lead one to suspect a pleural infection (Verco, "Austral. Med. Gaz. 1896, p. 321). These signs led to a diagnosis of pleural hydatids in case 8, re-corded below, together with the withdrawal of hydatid fluid on exploratory puncture. There is also usually, less cough with no expectoration of blood..

The prognosis in these cases is good, if the cyst is single.

Hydatids of the Spleen. Symptoms with hydatids of the spleen are not common. Verco and Sterling say "One half of the recorded cases were unsuspected during life and re-cognised after death, which would indicate that symptoms are frequently absent ("System of Med." Allbutt's, vol. 2, p. 1140) Of the 5 cases of which I have been able to obtain a record in India, all were discovered post mortem.

If the size is sufficient to cause a distinct tumour in the left hypochondrium, the condition may be diagnosed. The history, the absence of pain, and the examination of the

blood, to distinguish this from other splenic enlargements, will help in the diagnosis; then exploratory puncture will decide if the condition is one of hydatid cyst. Several cases of the spontaneous cure of hydatids are on record (vide "St. Barts. Hospital Reports," vol. 8, p. 180, and "Path. Soc. Trans." vol. 18, p. 257).

The prognosis is favourable if operated on. If the cyst rupture into the left lung, the accident is fatal. The cyst may rupture into the intestine and yet the patient recover (Lencel, "Kystes Hydatiques de la Rate" Amiens, 1879, Obs. 32, p. 71). A case has been recorded in which a hydatid cyst of the spleen ruptured into both the intestine and the urethra. ("Brit. Med. Jour." vol. 1, p. 968).

Hydatids of the Kidney. Here again, the symptoms may be wanting The history usually given is that of a slow growing painless tumour, without any change in the function of the organ. There is no pyrexia or general disturbance and examination of the urine proves it to be normal. The physical signs are those of a renal tumour. Fluctuation may be felt, as in the case recorded below (no. 4), on bi-manual palpation. There is very little if any tenderness. The fingers can be insinuated above the tumour, isolating it from the liver. If suppuration has taken place, there may be pyrexia, with pain in and tenderness over the tumour along with pyurea. Rupture of the cyst into the urinary tract is common. In a series of 79 cases, col-lected by Thomas, 50 ruptured in this direction; in 64 col-lected by Berand, 48 terminated thus (Thomas, "Hyd. Dis." vol. 2, P. 25).

If rupture in this direction takes place, renal colic will supervene, but there will be little or no haemorrhage. The diagnosis is not difficult in most cases when the tumour has reached a fair size. The passage of "skins" per urethram will at once make the case plain. Exploratory puncture should always be performed through the lumbar region.

The prognosis is favourable if only one kidney is affect-ed, as is usually the case,

Hydatids of the Omentum, Mesentery and Peritoneum. The chief physical signs of a hydatid cyst in these regions are the free mobility of the tumour on bimanual palpation, and the shifting of the position of the tumour, when the posture of the patient is altered. (vide Stanmore Bishop,, "Brit.Med.Jour."1893,vol.2,p.1107).

As to the differential diagnosis, the "Thrill" may be pre-sent in these cases, but without exploratory puncture, it is frequently impossible to diagnose the condition from omental sarcoma etc. (Verco and Sterling). Puncture should always be performed only after every thing is prepared for further operation, as in the case of lung hydatids.

The prognosis is unfavourable, owing to the frequency of multiple cysts in these regions.

Hydatids of the Male Pelvis. If large, the tumour may give rise to pressure symptoms, such as on the rectum result-ing in chronic constipation and perhaps tenesmus; on the bladder, causing retention of urine with its sequelae; or on the urethra, causing hydronephrosis. On the other hand, even large tumours may give rise to no symptoms

The prognosis is favourable if the cyst is single and operation be performed.

Hydatid Disease of the Female Pelvis. The disease in more common in the female than in the male pelvis, but the symptoms just described are those found in the female also with this addition that there may be obstruction to labour. (Saddler, "Med.Times & Gaz." 1864, vol.2, p.141. In this case, Caesarean section was performed. Grünsberg and Chackow, "Centralblatt.für Gynëkologie," Nov.15th, 1884. Boissard and Condert, "L'Obstét." March 15th.1901. In this case the cyst was tapped and removed after delivery. It resulted in recovery.

Hydatids of the Heart. This condition has never been diagnosed during life and it usually ends in sudden death. In the middle of the 19th. century, it was believed that hydatid disease of the heart never occurred alone, but was always accompanied by cysts in the liver. Budd held this view ("Med.Times & Gaz." 1858, vol.2, pp.54-6) and was supported in it by, amongst others, Murchison ("Med.Times & Gaz." 1860, vol.1, p.484, in a discussion on a case of Wilks) In 1872, Peacock recorded a case which disproved this theory and re-fered to one of Budd's own cases in which hydatids occurred in the heart alone ("Med.Times & Gaz." 1872, vol.2, p.473). In a list of 48 recorded cases collected by Thomas, only 17 were accompanied by.cysts in the liver, the remaining cases were of cardiac infection alone ("Hydatid Dis." vol.2 pp.70&71).

Hydatid Disease of the Brain and Spinal Cord. The symptoms of hydatids in the brain and spinal cord are much the same as those of any other tumour in the same situations.

In cerebral hydatids, the earliest and most constant symptom is headache. After the lapse of some time, epileptic fits may occur. There is in a large percentage of cases (about 50 %) blindness. In a fair percentage of cases, vertigo has been recorded, also nasuea and vomiting (vide Stewart's case, "Lancet," 1848, vol. 2, p. 103, also Wilson's case, ibid p. 143). Optic neuritis and atrophy may be noticed. Convulsions of some kind, occur in a large proportion of cases, and eventually imbecility may set in. There may be a "staggering gait" at first, though towards the end hemiplegia or paraplegia may supervene.

The Prognosis is bad, death usually takes place within one year of the appearance of the first cerebral symptom.

As regards hydatids of the Spinal Cord,, the symptoms are those of compression of the cord with the supervention of myelitis. Exploration of the tumour is the only certain means of differential diagnosis.

The prognosis is very grave, the disease is invariably fatal.

Hydatid Disease in Soft Parts gives no particular symptoms, beyond the physical signs of a slow growing, painless, cystic tumour. Aspiration makes the diagnosis clear. The con-dition has been mistaken for fatty and other tumours (vide "Indian Med. Gaz." Oct. 1902, p. 390). The resemblance between a guinea-worm abscess and a hydatid may be very great. I have seen a case of hydatid cyst presenting exactly the same phys-ical signs and history as one of guinea-worm abscess. Urticaria may be present in both, though in my cases it was

absent in both. There was no pain or pyrexia in either and the situation was exactly the same in the two cases. Incision however, made the diagnoses plain. In hydatid disease the history given is usually too long for guinea-worm abscess but in these two cases, the history was of the same duration. From the one, a typical cyst-wall, in which scolices were afterwards found, was removed, while from the other, a complete dead guinea-worm was evacuated, immediately the incision was made, along with about a pint of pus.

The prognosis is good. Death in such a case is very rare.

Hydatid Disease in Bone. This condition gives rise to no special symptoms The growth is usually painless, nor is there much thickening of the bone. There is erosion of the medullary portion of the bone, but frequently the pres--ence of the disease is only revealed on fracture of the part, in the case of the long bones. In the case of flat bones, the cancellous tissue is much eroded and may be perforated, so that a tumour much resembling a hernia, because it may to some extent be reduced with a gurgling feeling, may be produced outside the bone, as in case 10 recorded below. A similar case is referred to in the "Indian Medical Gazette" 1896 (p.183), an extract from the "Archives Cliniques de Bordeaux", 1896, Jan.

Prognosis.. In the case of long bones where the part can be amputated, the danger to life is not great, if the condition be treated in time, but in other parts, the cases most commonly prove fatal, as suppuration particularly easily sets in. Cases are on record, however, in which the cyst has been successfully evacuated without loss of the limb, or loss of function of the bone. (Peacock, "Brit. Med. Jour." 1887, vol. 2, p. 632)

T R E A T M E N T

The treatment of hydatids by medical means has had many advocates and many are the drugs that have been used. At one time there was a wide spread belief that common salt administered by the mouth would kill the scolices contained within the cysts. Ordinary anthelmintics have been used per orem in the hope that they would kill the larvae and their nourishing parenchymatous layer. When it is remember--ed, however, that the larva lies inside the thick fibrous capsule, securely shut off from the entrance of drugs and that no vessels pass from this capsule to the cyst proper, it will be understood that long before sufficient medicine has penetrated the capsule, by osmosis, to kill the larva, the patient would in all probability be much overdosed. If the larva were not thus surrounded and protected, it might be possible to kill it with drugs, much in the same way as the guinea-worm can be destroyed by sulphur given internally.

Amongst the drugs that have been administered by the mouth, each having been strongly recommended by various writers, are turpentine, felix mas, potassium iodide, and potassium bromide and kamala. The latter was supposed to be very efficacious by Dr. Leared ("Medical Times", 1860, vol. 1. p. 344) and also by Dr. Hjaltelin ("Edin. Med. Journal", Aug. 1867). Dr. Bird was also a strong supporter of the medical treatment of this disease. He writes "I have, from the experience of a large number of cases, quite convinced myself that bromide of potassium and kamala have a decided influence over the vitality of the parasite when given in

continuously large doses." ("Med. Times & Gaz." 1878, vol.2. p.164). However, Bird himself used to resort to paracentesis in most cases. He used to tap hydatids of the pleura and liver and send them out from his consulting-room.

When the fruitlessness of general medical treatment was fully established, various methods short of operative interference were tried. The chief of these were acupuncture, electrolysis, aspiration and partial aspiration with subsequent injection of various fluids.

Acupuncture consists of the insertion of fine needles into the cyst. When inserted, they are left for from ten to fifteen minutes. Several cures by this method have been reported, but the cure is probably brought about by the draining of the hydatid fluid into the surrounding tissues. This is a dangerous sequence, as the fluid which has thus escaped may infect fresh tissues previously healthy and thus spread the disease to organs from which it is impossible to eradicate it by operation.

Electrolysis was much recommended by Jagge. In his book "The Principles and Practise of Medicine," he says "This operation has been practised several times at Guy's Hospital by the author and Mr. Durham, who published in the "Medico-Chirurgical Transactions" for 1872, the reports of eight cases, in seven of which (if not in all of them) this plan of treatment was completely successful, being followed in most instances, by total disappearance of the tumour." Jagge goes on to say that the success of this operation was supposed to be attributable to the decomposition of the saline fluid

contained in the cyst, at first, but that in several of his cases, fluctuation could be felt in the lower part of the abdominal cavity a few hours after the electrolysis had been performed, and states that in two cases, a rash like an urticaria followed the operation on the first or second day. Mc.Gillivary having reported a case in which urti--caria occurred after the discharge of some hydatid fluid into the peritineal cavity, it seemed that the cure by elec--trolysis was identical with that by means of acupuncture and that the fluid escaped into the surrounding tissues.

Aspiration or paracentesis has been specially recommended by Murchison in England, Boinet and Dieulafoy in France, by Hjaltelin in Iceland, and by Hudson, MacGillivary and Bird in Australia. This method has been very widely adopted and is still in vogue. Thomas remarked, in 1899, "Until quite recently in Australia puncture has been the recognised re--gular mode of treatment for all cases of internal hydatids. This fact alone should be proof that sometimes cure results from tapping operations." (Thomas, "Hydatid Disease" Vol.2, p.189). Some physicians draw off only a small quantity of fluid, while others withdraw as much as will flow. The loss of a little fluid will often be sufficient to kill the parasite and a process of retrogression is set up so that the tumour may eventually entirely disappear. After mention--ing that Sir Benjamin Brodie and Bright performed the oper--ation successfully on several cases, Murchisonsays (1877) "The safety and efficacy of the operation now recommended may be regarded as established." ("Clin. Lect. on Liver Dis.

p.78). He collected a list of 109 cases treated by this method, 82 of which resulted in cure, 16 others suppurated and were treated by incision and drainage, the remaining 11 were fatal. ("Dis. of the Liver," 3rd.ed.p.78-82.).

Regarding the effect on the parasite of the removal of a small amount of fluid, Murchison writes "Experience has shown that removal of the liquid which is as thin and limpid as water, suffices to destroy both the parent hydatid and the offspring, and accordingly, this is all that is necessary. The injection after removal of the fluid of such substances as alcohol, oil of male fern, iodine, or bile is unnecessary and may be injurious, by exciting excessive inflammatory action ("Clin. Lect on Liver Dis." p.76)

After aspiration, the fluid often recollects and the tumour regains its former size. One of my cases (no.3, recorded below) is a good example of this. In such cases it is often found that the fluid withdrawn at the second aspiration, contains albumen which indicates that the cyst is now filled with serous exudation. Should this be tapped there is a greatly increased liability to suppuration. It is therefore a safe rule to postpone a second tapping till at least 12 months have elapsed since the previous operation.

The ultimate results of paracentesis are not altogether satisfactory, although there appears to be a temporary cure. Several cases have been recorded in which after the elapse of a long period of time, either suppuration sets in in the old cyst or the hydatids recur or the dried-up remains of the cyst cause irritation which may end in death. Jagge

draws attention to an example of the late occurrence of suppuration ("Princ.& Pract.of Med.," 2ed.vol.2.p.556), where as Bruce Clarke quotes a case of Mr.J.Hutchinson's, in which hydatids reccurred after a period of 11 years seeming free--dom from the disease ("Brit. Med. Jour." 1893,vol.1,p.690). Mr. Bond reports a case in which post mortem,"the only con--dition found on examination was a very extensive cicatricial and fibrous liver change, involving the large vessels round an old shrunken hydatid cyst," the solid endocyst and daughter-cysts of which were apparently keeping up the source of chronic irritation ("Brit. Med. Jour." 1893,vol.1,p.771). At the Intercolonial Medical Congress, in a paper by Jones and Scott-Skirving, it was stated that aspiration was not to be recommended in hydatids of the lung though it had its place in the treatment of abdominal cysts. Other speakers, however, Verco, Ellis, Graham, Ryan and Chisholm, all sup--ported the method of treatment by incision and drainage in all organs. Verco stated "that tapping a hydatid cyst any-where is dangerous, it might cause sudden death." Graham, however, stated that tapping was necessary in some cases of multiple cysts.("Brit.Med.Jour." 1892,vol.2,p.1296).

Soon after aspiration was introduced, either total or part--ial aspiration with the subsequent injection of various fluids was tried. Amongst the drugs used for this purpose are the following :- mercury perchloride, which was used in three ways. Nanot used 25 to 30 cb.cms. of a 1 in 1000 sol--ution, which he injected and left. Delove and Mesuard used a larger quantity of a solution of this strength and allowed

it to escape again after ten minutes. The quantity usually used was one to five hundred cubic centimetres. Bacelli withdrew from 20 to 50 c.cms. of hydatid fluid and then in-jected an equivalent amount of a 1in 1000 solution of Corrosive Sublimate. Berrucio used a 1 to 5 % solution of silver nitrate. In addition to these mentioned, many drugs have been used for the subsequent injection. Tincture of Iodine has been largely employed and carbolic acid, alcohol, extract of male fern, potassium permanganate, and ox bile have all had their turn. Skene mentions a case of Mc.Ken-nion's in which hydatids of the bladder were destroyed and discharged per urethram after the injection of a French preparation of liquor sodae chlorinatae, the patient being cured. (Skene's "Diseases of Women", 1890ed. p. 779)

Mention should be made of some methods which are now obsolete but which have all been recommended. 1. Recamier's method, in which caustics were applied repeatedly at short intervals of time, till the surface of the sac was reached or even until an opening into the sac itself was effected. The mortality of this method of treatment was great (34%, Thomas). Besides this high mortality, there are other reasons for the abondonment of this method. They are its painfulness, its prolonged duration, its total inapplicability in some localities and the uncertain adhesions formed.

2. Simon's method, in which two trocars and cannulae were in-troduced into the cyst and allowed to remain till adhesions had formed between the cyst capsule and abdominal parietes, or till suppuration had begun. The cyst was then opened in

-ta, between the two canulae. This method of treatment reduced the mortality greatly. 3. Canule-a-demure, in which method a canula was lixed into the cyst and long con--tinued drainage allowed to take place. The mortality in this method of treatment was 27 %.

Jagge remarks concerning these methods that "when these various plans were proposed, it was not known how safely and successfully hydatid tumours might be treated by the simpler methods above described" namely acupuncture and aspiration.

Early in the year 1851, Dr. Todd wrote "I know of no cure for hydatids but the evacuation of them," but it was not till the year 1871 that the cyst was deliberately incised and cleared out, when Lindemann sutured the capsule of the cyst to the parietal wall. Though Lindemann was the first to perform this operation, the earliest account published was in 1879, by Kirchner ("Ein Beitrag zur operation der Echin--ococcen der Organe der Bauchhohle", Berlin).

This method of treatment has been very widely adopted and is the chief method in vogue at the present time amongst Australian surgeons, and was the method adopted in the one case of hydatids of the liver that I have had under my care.

Volkmann modified Lindemann's method of operation by ex--posing the cyst and packing the wound at the first operation, and a week later when adhesions had formed, emptying and draining the cyst.

In 1891, Bond recommended, in the case of abdominal cysts, that the cysts should be first exposed and tapped so that

some of the fluid might escape, as in the removal of an ovarian tumour. This reduces the tension so that the ectocyst may shrink away from the capsule which allows it to be drawn up to or even out of the wound. The essential cyst is then removed as far as possible The cavity is now carefully emptied, cleansed and closed by sutures, or even left open, and the wound in the abdomen closed over as in an ovariotomy. Bond says "It may be concluded that certain abdominal cysts in which there is difficulty in bringing the cyst wall up to the surface of the body, can be treated by incision and replacement of the cyst provided that due care be taken to thoroughly evacuate the cavity of all its fluid and elastic solid contents and to suture the inverted edges of the incision afterwards. The haemorrhage and the accidents which have been described as following on detachment of the cyst wall, must have been due to the tearing away, not of the elastic membrane, but the outer wall or ectocyst (capsule ?) itself. The addition of a few catgut sutures in the inverted edges of the opening is to prevent the subsequent entrance of a coil of intestine. Any serum secreted by the cyst wall would, I feel sure, be rapidly absorbed. Further, I see no reason why we should not deal with cysts of the liver and other organs in the same way provided that suppuration has not occurred, and that sufficient length of incision into the cyst (one and half to two or more inches) could be made to allow of the complete evacuation. The elastic lining shrinks on first withdrawing the fluid and can be removed by gentle traction with the aid of an ordinary ring or bile forceps...

... It is highly important even in suppurating cysts in which drainage is necessary, to remove the solid contents at the time of incision." ("Brit. Med. Jour." 1891, vol. 1 p. 795-6.) In refering to this method of treatment, Bruce Clarke thinks that in the case of the liver, it would be safest to drain, at any rate for the first few hours. The results of this method in the experience of many surgeons, has been very s satisfactory. It is now being adopted as the routine method of treatment, largely, amongst those who have most to do with hydatid disease.

In certain situations, it is possible to remove the cyst whole, without rupturing the ectocyst, or it is even possible in some cases, to excise the fibrous capsule without expos--ing the ectocyst, as was done in case I under my care.

Writing in 1894, Gardner (in the "Austral. Med. Jour.", Aug. 20th., 1894) gives indications for incision and immediate removal of the parasite. They are as follows :- 1. In all hydatids of the external surface of the body, the sac should be dissected out like a tumour, and the wound closed, except in cases where scarring is important as in the breast and neck. In these, a small opening may be made, the contents removed and the wound in the cyst sewn up or drained. 2. In all unruptured hydatids of the lung, a radical operation should be immediately performed on account of the great risks accompanying rupture which is frequently caused by the re--moval of even a hypodermic syringe-ful of fluid. 3. In all cases of spontaneously ruptured hydatids of the lungs, in which the patient has escaped the risk of flooding of the lungs and of blocking the glottis with membrane, the

surgeon may wait, but if a suppurating and freely secreting cavity be left, portions of one or more ribs should be ex--cised and the cavity drained at the lowest point. 4. All hydatids of the abdomen should be subjected to some radical operation, whether suppurating or not. Of the operations for abdominal hydatids in which drainage is required, the best is Volkmann's, with iodoform gauze plugging, for the practitioner who cannot obtain skilled assistance. When such assistance can be secured, the author would recommend stitching the cyst to the parietal peritoneum all round, then emptying the cyst and fixing it to the peritoneum and muscles, and douching till all the contents are removed. Of operations for abdominal hydatids in which drainage forms no part of the treatment, the author thinks that complete removal of the sac can be done in rare cases, specially when the cyst is attached to the omentum. In Bond's operation, in which the cyst is closed by sutures and dropped into the abdominal cavity, after it has been opened the author would fix the sac to the peritoneum on each side by one stitch, if the cyst can be brought up to the abdominal wound. Whenever the cyst cannot be brought up to the external wound, it must be emptied and all fluid removed, then the hole in the sac should be carefully sewn up and the cyst dropped into the abdomen 5. Tapping may very rarely be indicated in cases of doubtful diagnosis, to be followed by immediate operation if characteristic fluid be obtained."

At the present day, the treatment varies very consider--ably with the situation of the disease. Different methods

have to be adopted in different organs, but also the con-
-dition of the ectocyst has to be taken into consideration.
With the improved methods of general surgery, the treatment
of hydatid disease has become more bold. Where possible the
cyst should be cut down upon and removed without rupturing
the ectocyst. It is quite unnecessary to remove the fibrous
capsule, as this in no way hinders the healing of the wound,
nor does it cause any irritation if left. It is formed from
the surrounding connective tissues, so that it is usually
very difficult to dissect it out, and if this is attempted,
the wound is rendered unnecessarily large and the bleeding
is profuse, thereby is the danger of the operation increased.
If it is found impracticable to remove the cyst without
rupturing it, then it should be drained by a trocar or a
small incision. When some of the fluid contents has escaped,
the ectocyst may very often be removed en masse, it being
shelled out from the capsule to which it is not adherent.

Changes may occur in the ectocyst which make it impos-
-ible to shell it out. In such cases, as much as possible,
of the ectocyst should be removed, by scraping, after the
contentshave been thoroughly removed by means of irrigation.

In cases where the whole cyst has been removed, no drain-
-age is needed, except in the case of the liver. But if it
is impossible to remove the entire cyst wall, a drain should
be left in for a few days at least to see if any discharge
takes place. In no situation is it advisable to merely
puncture, and if the cyst is punctured at all for diagnostic
or other reasons, the surgeon should be ready to proceed at
once with the complete evacuation of the cyst.

To sum up, the history of the treatment of hydatids is as follows. Up to the middle of last century, hydatid cysts were almost invariably treated by drugs given internally (cf. "Med. Times and Gaz.", 1855, vol. 1, p. 159, 160, treated with Potassium iodide). In 1851, Adams says that "the treatment of hydatids falls more frequently to the share of the phys-ician than the surgeon." ("Lancet," 1851, vol. 1, p. 455). Dissatisfaction was already being felt, however, at the re-sults of this method of treatment and cases of paracentesis are now and again recorded (vide Adam's case "Lanc."/51, 1. 455) also cases of puncture and subsequent injection of various substances (Bobiller's case, "Lancet," 1851, vol. 2, 583, in which Tincture of iodine was injected) For several years from this date, the puncture and subsequent injection of various drugs was the method of treatment most in vogue The substances used have already been named and need not be again repeated Pavy strongly recommended the withdrawal of 4 ounces of fluid and the injection of that amount of a mixture containing male fern, liquor potassae and water. ("Lancet," 1866, vol. 2, p. 234)

About this time several methods of treatment were on trial, but paracentesis gradually became the favourite. Murchison was the great supporter of this method in England The treatment by drugs given by the mouth now began to be abandoned. Electrolysis was tried and recommended by Tagge and Durham, but this method of treatment never be-came very universal.

Radical operations began to be performed about 1865-1870, the first tried being the establishment of a fistula into the

cyst by means of caustics (Recamier's method), adhesions being formed between the organ affected and the abdominal wall. The caustic most generally used was potassa fusa. This method of treatment was extremely painful and protracted and was never in very general use, though even as late as 1887, it was employed now and again, as Harrison Cripps re-commends large incision in preference to it in that year ("Brit. Med. Jour." 1887, vol. 1, p. 211), whereas Pearce Gould and Dyce Duckworth recommended simple puncture. To obviate some of the disadvantages of Recamier's method, the insertion of a canula and the leaving of it in position for some time, the canule-à-demeure, was a method tried for some time.

In 1866, Simon, recognising the danger of allowing fluid to escape into the abdomen, and realising the defects of the canule-a-demeure method, introduced his operation, in which two canulae are introduced into the cyst about an inch apart, the diagnosis being confirmed by the first and stouter of the two. After adhesions have formed, an incision is made into the cyst between the two canulae.

In 1871, deliberate incision into the cyst and evacuation of the contents, after stitching the cyst wall to the parie-ties, was performed for the fisst time by Lindemann. Although when first performed, this operation was somewhat of an accident, its advantages were soon established, and the operation rapidly became general after the publication of an account of the Method by Kirchner, in 1879 ("Ein Beitrag zur Operation des Echinococcen der organ der Bauchhohle", Inaug. Dissert., Berlin, 1879)

Lindemann's operation was modified by Volkmann, who operated in two stages.

In 1881, Lawson Tait published four cases in which Lindemann's method had been followed ("Birmingham Med. Review" October, 1881). In 1886, Spisharny quoted statistics to show that the method by incision was coming into favour in Russia and other places (cited in the "Brit. Med. Jour." 1886, vol. 1. p. 895). At this time accounts from Australia showed that this had become the routine method of treatment of hydatid disease in that country ("Aust. Med. Jour." June, 1889) In 1889, Thomas published a list showing the mortality of the various methods of treatment. They are as follows:- Caustics, 33.68 %; canule-à-demeure, 26.66 %; Simon's method, 48 %; Volkmann's method, 19.05 %; Lindemann's method, abdominal sections, 10.29%; Lindemann's method, thoracic incisions, 29.41 %. ("Transact. of 2nd. Intercol. Med. Congress" Melbourne, 1889).

In 1891, Bond recommended, for abdominal hydatids, the incision and removal of the whole essential cyst, with the closure of the cavity left, and the sewing up of the abdominal wound as in an ovariotomy.

These are the most noted methods of treatment of hydatid cysts, and from these there have been many variations and modifications, the most recent being that of Quenu, who recommends the injection of 1 % Formaline irto the cyst before it is removed. His idea is that this will kill the scolices and render the danger of infection of healthy tissue from leakage of the fluid nil. ("Bull. et Mém. de la Soc. de Chir. de Paris, 1903, No. 25)

It is necessary to consider the treatment of hydatid disease regionally as well as the special treatment when certain degenerations of the cyst have taken place, in addition to the general rules laid down above. The organs will be considered in the order that they are most commonly affected. Liver. As Bruce Clarke says in the article refered to above, "the treatment of hydatid tumours (of the liver) lies between puncture with an aspirator or troquar and drainage, or removal by incision." He describes the dangers of aspiration though conceding that puncture does effect a cure in a certain number of cases. He gives as the chief dangers, the spread of the disease to other organs, the unaccountable fatal issue attendant on simple puncture in a number of cases, the danger of incomplete removal and in those cases where the cyst has extended into the lung, of the flooding of the healthy lung and consequent suffocation. Since these remarks were written, it has become the almost invariable rule to treat hydatid cysts by incision and evacuation. After the patient has been prepared in the usual way for operation, the abdomen should be opened and the liver exposed. The general peritoneal cavity should then be shut off by means of gauze or abdominal towels, or the visceral peritoneum civering the liver should be sutured to the parietal peritoneum. The cyst should then be incised and a portion of the fluid allowed to escape. If the cyst be not lobulated or if it be small, the whole ectocyst can be removed by gentle traction, in which case the cavity may either be entirely closed or it may be drained for a day or two, the

abdominal wound being closed entirely except for the drain-
-age tube if that is inserted. In 1898, Bobroff report-
-ed 4 cases of liver and 1 of pancreatic hydatids in which he incised the cyst, let out the fluid, removed the chitinous wall and carefully disinfected the interior of the fibrous capsule. He then completely closed the sac and the abdomin-
-al wall by sutures allowing for no drainage. He states that the transudation of fluid only takes place if the cavity is left open and drained. In all these cases convalescence was rapid. If, however, the cyst should be lobulated or if degeneration of the ectocyst has taken place, it will be found impossible to do more than evacuate the contents thoroughly by irrigation with saline solution or with weak mercury, and then scrape the walls gently to remove as much as possible of the adherent tags and degener-
-ated material. The capsule may be found to have undergone degeneration and be calcareous. It will be well to remove as much as one can of this material, though this must be done with great caution to avoid breaking down the sound liver tissue beyond the capsule. In case 5, described below, pieces of calcareous material cont nued to escape into the dressings for some time. It is necessary to freely drain the cyst cavity in these cases, as even after it seems that all the contents have been thoroughly removed, bits of daughter-cysts and degenerated material may escape into the dressings. If suppuration should have set in, the condition becomes one of liver abscess, and thorough drainage, with irrigation of the cavity every day till suppur-

-ation has ceased, should be carried out.
Complete excision of the cyst in the liver is inadvisable, even though possible, as the bleeding set up by the removal of the fibrous capsule from sound liver substance is profuse and difficult to check, though cases are on record of very successful operations of this sort (Palleroni, "Gaz. degli Osled." Aug. 7th. 1898) Bile also may be extravasated, which will cause considerable irritation. On account of these two possibilities, the danger of the operation is much increased.

If the cyst should be growing from the posterior and upper surface of the liver, it may lie under cover of the diaphragm in such a position that it cannot be reached by a laparotomy. Under these conditions "the best plan is to remove a portion of the 8th. or 9th. ribs in the anterior axillary line, to suture the parietal to the diaphragmatic pleura and then to incise the diaphragm. If adhesions have formed between the cyst and the under surface of the diaph-ragm, there will be no further difficulty and the cyst can be laid freely open.....If however, adhesions are absent, the steps of the operation will be identical with those for the treatment of the cyst through a laparotomy wound, the edges of the cyst wall being pulled through the opening in the diaphragm and attached to the deeper part of the wound" (Cheyne and Burghard, "Man. of Surg. Treatment", Pt. 4, Sect. 2, p. 122). Cases in which this transpleural route has been adopted are reported by Cendon ("Sect. on Hydatid Dis. of the Lung" p. 100 - the first case which was deliberately operated

on by this method), Paget ("Brit.Med.Jour." 1895, vol.2, p.1095), Footner ("Brit.Med.Jour." 1902, vol.1, p.1273) and others.

"When a hydatid of the liver has burst into the abdominal cavity, the proper treatment is immediate laparotomy and thorough flushing of the abdominal cavity followed by removal of the cyst wall and drainage of the cavity left." (Cheyne & Burghard, loc.cit. Pt.4, Sect, 2, p.123)

Recently, Quénu advocated, inthe case of abdomina hydatid cysts, the injection of 1 % formaline into the cyst before its removal to guard against any secondary infection of the peritoneum, an accident which by experiment on animals and by clinical observation, he is convinced can happen. He reports 3 cases in which convalescence was rapid, in spite of unfavourable circumstances in two of the three. Healing was not hindered by prolonged contact of formaline with the cyst wall("Bull.et Mém.de la Soc.de Chir.de Paris," 1903, no.25).

Lungs and Pleura. Hydatid cysts in the lungs should be treated very carefully. Good results have been obtained by aspiration, but this method of treatment in lung hydatids is particularly risky, as the cyst may easily be punctured or ruptured internally., whereupon the fluid will escape into the bronchi and cause suffocation. Graham and others record cases in which the healthy lung was flooded and the patient immediately suffocated. Mackenzie reported a case, which proved fatal in 9 hours after tapping, by rupture into a bronchus, at a meeting of the Clinical Society, April 8th., 1892. Bristowe, then, expressed the opinion that it was much more dangerous to tap a living than a dead cyst ("Brit.

Med. Jour.", 1892, vol. 1, p. 814). Before exploratory puncture is made, all things should be prepared for a thorough evacuation of the cyst, as even exploratory puncture may cause very grave symptoms and on occasion, death. ("Brit. Med. Jour." 1890, vol. 2, p. 1426).

The position of the cyst having been noted, an incision should be made over the most suitable rib and a piece of it resected. If the cyst is extensive, it will be necessary to remove pieces of two or more ribs. When the pleura is exposed, the visceral layer over the cyst should be united to the parietal, unless adhesions have already taken place. The cyst should then be punctured and some of the contents removed, so that the ectocyst can be drawn partly out of the wound, if possible. If this is not possible, the cyst should be incised and the contents removed as thoroughly as possible. Cheyne and Burghard state that "no washing out of the cyst should be adopted," but if the cysts are in the pleura, no harm will result from this treatment, and if suppuration should have set in, irrigation is necessary ("Man. of Surg. Treat." Pt. 4, Sect. 2, p. 548). An interesting discussion is reported very briefly in the "Brit. Med. Jounal" of 1892 (Vol. 1, p. 227) in which Dyce Duckworth, Howard Marsh, Ord and others state that washing out a lung cavity is very dangerous, though the latter thought that, in the event of suppuration, the cavity might be very cautiously douched out. Marsh thought that the difficulties of lung surgery (for hydatids included) were very great. The difficulties were 1st. haemorrhage, 2nd. insufficient room, even when pieces of

two or three ribs are resected, 3rd. the impossibility of shutting off the wound from the air.

In case 8, recorded below, irrigation was constantly employ--ed from the time of the first operation for several months without any untoward result.

If multible hydatid cysts exist, the various cysts should be opened through the original incision if possible.

The reports of the treatment of lung hydatids by Australian surgeons are favourable (vide Lendon's "Clinical Lect."), and the case under my own care, though it was one of multible cysts, which necessitated several operations and though the patient was extremely ill for a very long time, ended in recovery. Vespa, in 1894, reported one case in which good results fol--lowed the inhilation, by means of a Siegle's inhaler, 20 to 30 c.cm. of ether twice a day ("Il Policlinico". Oct. 1st, 1894) I have not seen any further mention of this method.

Kidney. Rarely is the kidney so far destroyed that nephrectomy is necessary. In the case of a very large cyst in which the kidney substance is very much destroyed, and there is a mere shell of renal tissue forming the capsule of the cyst and specially if suppuration has set in, the organ may be completely removed. In the vast majority of cases however, even though the cyst is a large one, it should be evacuated and drained. Lucas, in 1883, said that aspiration seemed to cure hydatids of the kidney ("Brit. Med. Jour.", 1883, vol. 2, p. 613). After aspiration the cyst frequent--ly bursts into the pelvis of the kidney and is discharged per urethram, but this sequel is not without considerable

danger from suppuration.

The kidney should be exposed extraperitoneally and the capsule sutured to the abdominal wall. If the abdomen has been opened through an erroneous diagnosis, the wound should be closed and the cyst emptied from behind. Cases have been recorded in which renal hydatids have been drained through the middle line of the abdomen, but this proceeding is risky. ("Brit. Med. Jour.", 1887, vol, 2, p. 17). The most convenient incision is one running parallel to the last rib, about half an inch inferior to it, starting from the outer margin of the erector spinae and prolonged as far as is necessary. The kidney is sutured to the deep layer of the lumbar aponeurosis and the cyst then evacuated. After as much as possible of the contents has been removed, the cavity should be thoroughly douched out with either boracic lotion or weak lysol and a drainage tube inserted. A sinus may persist for some time, which should be closed by the usual methods of treatment of urinary renal fistulae.

Very rarely it may be possible to excise the portion of the kidney in which the cyst lies, if the cyst is a small one. In such a case, the wound in the kidney is sutured and the abdominal wall completely closed.

Omentum, mesentery and peritoneum. When the disease is situated in these structures, Bond's method of treatment, above described, is specially suitable, care being taken to avoid the escape of hydatid fluid into unaffected portions of the peritoneum.

Spleen. Splenectomy has been recommended as the appro-

-priate method of treatment for hydatids of this organ. This operation, however, is extremely severe and adhesions have formed usually which would render the operation very difficult and the liability to shock very great. It is safer to open and thoroughly drain the cyst by methods sim--ilar to those stated for renal hydatids, as in a case re--ported by Mc. Caren, ("Brit. Med. Jour." 1892, vol. 1, p. 965 There is one danger from this method of treatment, and that is haemorrhage, (Verco & Stirling, Allbutt's "Syst. of Med." vol. 2, p. 1140) Roche states that the treatment of hydatids of the spleen by incision and drainage is 30 %, while Hahn holds that the atrophy, usually present, facilitates the removal of the organ, and Hartmann quotes 11 cases treated by splenect--omy with only 2 deaths ("Gaz. de Hopit." 1896. p. 1214).

Muscles and Soft Tissues. When hydatid cysts occur in muscles or areolar tissue, they can usually be well exposed and the ectocyst shelled out either whole or after a portion of the fluid has been evacuated. It may be possible to ex--cise the capsule entire, as was done in case I recorded be--low, but this is not usually possible as the adventitious capsule is so intimately connected with the surrounding struc--tures. Nor is complete excision at all necessary, as after the ectocyst has been removed the wound can be closed without drainage and healing takes place by first intention, under the usual antiseptic precautions. If there has been much escape of the contents of the cyst into the tissues, it is advisable to introduce a small drainage tube for 24 or 48 hours.

Orbit and Eyeball. When situated in the orbit, the cyst can usually be removed by dissection, as was done in the three cases treated at Bannu, N.India, a report of which was kindly given me by Dr. Pennel. In the cases of infection within the orbit, that have been under my care, the lachry--mal gland has been the seat of the mischief, but in one the sight was totally destroyed and the cyst had caused so much proptosis, that it would have been useless to leave the eye ball had the condition been diagnosed before operation. If the cyst cannot be dissected out, it may usually be drained, without total enucleation of the ball. ("Brit.Med. Jour." 1900, Ebit.no.77, Lavagna's case). The drainage may be affected through one or other eyelid, as in the case recorded by Sharp, which was drained through the lower lid("Brit.Med. Jour." 1890, vol.1, p.179). If the eyeball itself is infect--ed, the only method that can be adopted is ennucleation, it being impossible to remove the bladder without destroying the eye, as may be done in the case of a cysticercus infect--ion Of the removal of both free cysticercus and also the bladder with the cysticercus contained, without enucleation, von Graefe records several successful cases ("Archiv.f.Opht--thalmologie," 12, 1874).

Bone. If the infection occurs in one of the long bones, it may be possible to incise the cyst and scrape out the contents, as in cases reported by Leared and others("Brit. Med.Journal," 1887, vol.2, p.1283; 1892, vol.2, p.632) If the disease is extensive, however, or if suppuration should have set in, it will be necessary to amputate the limb. When

the disease affects an irremovable bone, the condition is a very serious one. Suppuration is peculiarly liable to occur and if it does, the case is hopeless.

Brain and Spinal Cord. Hydatid cysts have been successfully removed from the brain by trephining and evacuation. (vide cases reported by Graham and Grubbe and Thomas, "Austral. Med. Jour.", July, 1890). This is the only method of treatment that can be adopted. When situated in the spinal cord, they must be treated by incision and evacuation. The diagnosis is rarely made during life, however, though Horsley removed a cyst from the cord in a case of Gower's and the patient lived for a long time after. (Gower's "Dis. of the Nervous Syst." 3rd. ed. vol. I, p. 306) Some times even though the patient has been operated on, the hydatid cyst is not discovered till post mortem examination is made, as in a case recorded by Ransom and Anderson ("Brit. Med. Jour." 1892,)

Prophylaxis. In countries where hydatid disease is common great attention should be paid to this subject, as the disease is to a large extent preventable by careful prophylaxis. As the disease is spread almost entirely, through the instrumentality of dogs, these animals should be carefully looked after and means adopted to destroy any worms that exist in their alimentary canals. Specially should their excreta be rendered inocuous. Cobold recommends that boiling water should be thrown over their foeces, not only in their kennels, but in all places where their excreta are exposed ("Treatise on Parasites", also Quain's "Dict. of Med."

1886 ed. vol. 2, p. 655). Dr. Leared proposes that every dog should be treated with an anthelmintic and cathartic at reg--ular intervals, strongly recommending kamala ("Med. Times & Gaz." 1863, vol. 2, p. 270-1) Leuckart gives the following advice :-"In order to escape the dangers of infection, the dog must be watched, not only whilst he is within the house, but also while he is outside. He must not be allowed to visit either slaughter houses or knackeries, and care must be taken that neither the offal or the hydatids found in such are accesible to him. In this respect, the sanitary inspector has many important duties to perform. The carelessness with which these offals have hitherto been disposed of, or even given purposely to the dog, must no longer be permitted if the welfare of the digestive organs of mankind is to be con--sidered.....Cleanliness is one of the most important preserv--atives against infection("Unsere Zeit," 1862, p. 654). It is a good rule never to drink water drawn from open places without having it previously boiled. In a case known to me, infection was traced to the patient having drunk some water from an open pool, while out shooting in Cambridgeshire. In India, the rule that all drinking water should be boiled, is very neces--sary for the avoidance of many diseases, including hydatids. Cases have been known to occur amongst Europeans in this country as well as amongst natives. Vegetables which are eaten raw should be particularly well cleansed before consum--ption. In India, it is very difficult, at any time, to get the natives to boil their water, before using it, but it is impossible to persuade any but the most enlightened, to make a practice of it. Some good, however, may be done by advising the constant use of draw-wells, to which dogs have no access.

THE DESCRIPTION OF CASES UNDER OUR OWN CARE.

Case 1. Hydatid Cyst in the Axilla. Kammlammah, a woman of about 40years of age, a cooly of the leather-worker caste, came to the hospital on November 1st. 1899, complaining of a swelling in the left axilla.

The history given was that two years before her admission, she first noticed a small swelling in her left arm-pit. This tumour gave her no trouble in any way, so she took no notice of it. It steadily grew however, and recently, on account of its size, has caused her some inconvenience, though it has never given her pain.

On admission, the patient was found to be in good general health, but on examining the left axilla, a tumour, the size of a man's fist was seen situated towards the anterior border and on the inner side, somewhat under cover of the pectoralis major muscle. It was freely moveable and fluctuation was evident on palpation.

Treatment. Under chloroform, the tumour was excised. In the course of the dissection, the cyst was opened into and a clear, watery fluid escaped together with some daughter-cysts. The opening was clamped with forceps and the capsule dissected out complete, with the cyst in situ. Before the patient left the hospital, another small cystic tumour was noticed, internal to the above and underneath the pectoralis major. The patient refused to have any thing done for this however, and has not been seen since.

On examining the cyst under the microscope, numerous scolices were found, and the ectocyst showed the typical

laminated structure.

Case 2. Hydatid Cyst in the Deep Tissues of the Neck. Bigardu, a man aged 28, a cooly of the leather-worker caste from Yellutla, came to the hospital on March 14th. 1903, complaining of a large tumour occupying the back andright side of his neck, which on account of its size, caused a certain amount of stiffness of the neck.

History. The patient had noticed a swelling in his neck about a year and half before he came to the hospital. This had steadily grown but had given no pain, so that had it not been for the inconvenience caused, he would not have come for treatment.

On admission, the tumour was found to extend from the middle line, on a level with the upper cervical vertebrae, to the posterior border of the sternomastoid muscle of the left side, on a level with the cricoid. It felt like a soft solid, was not moveable and seemed to be deeply situated. The diagnosis made was a fatty tumour.

Treatment. Under chloroform, the tumour was cut down upon and in the course of dissection, the capsule was ruptured, when a large quantity of clear, watery fluid escaped, with a few daughter-cysts, which made the diagnosis plain. The ectocyst could not be removed all in one piece, but the sac was thoroughly well scraped out. As soon as the finger was passed into the capsule, another and deeper cyst was felt, which was opened through the superficial one and was found to have very deep connections, the capsule being adherent apparently, to the axis vertebra. The whole cyst was then

well scraped out and packed and the wound partly closed. For several days after the operation, daughter-cysts were found in the dressings. The recovery was tedious as suppuration set in, but the wound eventually healed and the patient was discharged cured on April the 7th.

Case 3. Hydatids of the liver and Peritoneum. About May, 1903, Sankariah, a merchant of Proddatur, aged 50, come to the hospital complaining of great distension of the abdomen, which caused a good deal of breathlessness, though there was no actual pain.

History. The patient had noticed a swelling in the upper part of the abdomen for several years. This gave him no pain or inconvenience, but one day something seemed to "give way" in side his abdomen and he felt some pain. After this, the swelling increased in size rapidly. The patient then saw a medical man, who treated him for ascites and tapped the tumour twice. After each paracentesis, the fluid rapidly reaccumulated, so the patient went to Madras for advice. There he saw Colonel Maitland, I.M.S., who told him that an operation would have to be done and that tapping was worse than useless, evidently making a diagnosis of hydatid disease. The patient, refusing operation, came to us for treatment, when the following condition was found.

The abdomen was greatly distended by what at first appeared to be ascites. On palpation, however, the swelling was found to be not free fluid, but a tumour with distinct margins, limited towards the pelvis. A "hydatid thrill" could also be distinctly elicited. There was no pain or

tenderness, but the size of the tumour caused a good deal of breathlessness and discomfort.

Treatment. The patient refused radical treatment, being only willing to have paracentesis performed. This was not thought advisable, so some tonic was prescribed and the patient sent home. He has since his visit to us, again been to Madras and submitted to paracentesis. I hear however, that the fluid is again rapidly accumulating and that the patient is very weak. It seems probable that the disease originated in the liver, but that it spread to the peritoneum at the time when the patient felt "some thing give way" in the abdomen. The history is not at all clear, but no indication of shock or urticaria was obtained.

Case 4. Hydatid Disease of the Right Kidney. Matthew, aged 30, a Native Christian cooly, from Rameshwaram, a town in the Cuddapah District, came to the hospital on December 13th., 1903, complaining of a swelling in the right side of the abdomen, which gave him some pain.

History. Four years previously, in 1899, the patient came to the hospital with the same complaint, namely a tumour in the right side of the abdomen, which gave him a little pain. The swelling had then been noticed "for some time", the exact period of time being unknown. The pain, however, had only been felt for a few weeks. Apart from this condition, the patient declared himself to be in good health. The urine was quite healthy, there had never been any change in its character, and the motions had always been healthy. The patient was then given some medicine,

which relieved his pain, but in no way affected the swelling. During the interval that elapsed between this and his second visit, no change occurred in his condition, except that the swelling continued to grow steadily. Fifteen days previous to his admission, however, the patient began to suffer from severe pain, which was accompanied with high fever. The fever soon subsided, but the pain continued to be severe, so the patient returned from treatment. A few days after the pain began, the urine which up to this time had remained unaltered in character, became thick and showed a deposit if allowed to stand.

On admission, the patient was found to be a well nourished young man, in good general health. On examining the abdomen, a large tumour was plainly visible lying mostly in the epigastric and right hypochondriac regions, but also overlapping into the umbilical and right lumbar regions. It could also be distinctly felt at the back on bimanual palpation, being freely movable, fluid and tender. It did not move with respiration and seemed to be about the size of a cocoanut. The fingers could be easily insinuated between its upper margin and the lower margin of the liver. The urine when examined, was found to contain a little pus and blood. The diagnosis of hydronephrosis, with a recent conversion into pyonephrosis was made.

Treatment. The patient was put upon urotropin and potassium citrate, which cured the pus in the urine, but as the swelling was in no way affected, exploration of the kidney was decided upon. Accordingly, on December 23rd., the

patient was put under chloroform, and the kidney cut down upon. After the site of operation had been thoroughly cleansed, and incision was made parallel to the direction of the last rib and about half an inch below it, beginning about one inch from the middle line at the back and running downwards and forwards for about four and half inches. A portion of the kidney was broughtto the surface and sutured in the lower part of the wound. The substance of the organ was then opened into when a large quantity of clear fluid escaped with numerous bladders. The diagnosis now being made plain, the opening into the cyst was enlarged and the contents cleared out as thoroughly as possible, by douching. The contents consisted of a turbid fluid with a very large number of daughter-cysts, of very various sizes, and also a quantity of debris. It was evident that suppuration had just set in. A large rubber drainage tube was inserted into the cyst cavity and the wound almost entirely closed, being stitched layer by layer. Daughter-cysts continued to pass into the dressings through the drainage tube for about three weeks, but the wound healed by first intention except just in the track of the tube. A sinus into the kidney remained, through which urine and a little pus passed for a long time. This closed evertually and when seen three months after the operation, the patient was in good health with the wound entirely and firmly healed. The patient has been seen now and again since this time and remains in good health. There is no trouble either with the wound or the urine. He is able to do his work as well as ever.

Case 5. Hydatids of the Liver. Mariammah, a Christian cooly woman of about 50 years of age, from Utukuru, came to the hospital on July 29th., 1904, complaining of a painless tumour in the upper part of the abdomen, which caused discomfort on account of its size

History. Ten years previous to admission, the patient noticed a tumour in the upper part of her abdomen, about the size of an orange. As she felt no pain she took no notice of the condition although it continued to grow. She sought treatment at the present time, only on account of the inconvenience and breathlessness caused by the large tumour. She has never suffered from dyspepsia or any other symptoms of alimentary disease, nor has she ever had jaundice The foeces and urine have always been healthy in appearance and normal in frequency.

On admission, her condition was as follows, she was a fairly well nourished woman, in good general health. On examining the abdomen, a large tumour was seen lying mostly in the epigastric and right hypochondriac regions, but over-lapping into both the umbilical and right lumbar. The tumour seemed to move slightly with respiration and on palpation, seemed to be a tense cyst, fluctuation being made out in all parts of the swelling except the lower margin. At this part, the tumour was as hard as a stone. On deep palpation in this hard area, a feeling of grating was elicited. There was no pain or tenderness, except on deep palpation, neither was there any jaundice. The foeces and urine were examined and were found to be quite healthy.

The diagnosis lay between malignant disease with areas of softening, a distended gall bladder, with gall-stones and hydatid disease with calcareous degeneration of the cyst.

Treatment. The patient was put under chloroform and examined again, when it was decided tha the tumour was, most probably, hydatid. The abdomen was opened and the peritoneum of the liver sewn to the edges of the wound, then the cyst was opened, whereupon a quantity of thick material, crowded with tiny little daughter-cysts escaped. There was no clear fluid, the material which escaped being of the consistency of sago budding. About two pints of this material containing a very large number of daughter-cysts was evacuated. The cyst was thoroughly washed out and then explored with the finger. The lower hard margin was found to be calcareously degenerated, which when removed, looked and felt just like bits of necrosed bone. The daughter-cysts were very small, none being larger than a bantam's egg and the vast majority being only the size of an ordinary pea. The material in which they were contained seemed of a fatty nature and was bile-stained. None of the ectocyst could be separated from the capsule. The cavity was cleared out as thoroughly as possible and a large drainage tube inserted. A profuse discharge took place, which at first contained a large quantity of bile. This however, decreased on the 3rd. day and finally ceased on the 10th. day. Some suppuration occured and a small sinus remained for a very long time. It was practically healed on January 18th., 1905, when the

patient was allowed to go home- five months after operation.

Case 6. Hydatid cyst in the Muscles of the Back. Mariamma, a Christian woman of about 20, from Chenuru, a married woman whose only occupation was in her house, came to the hospital on November 6th., 1904, complaining of a tumour, situated just external to the scapula of the right side, which caused a slight amount of pain on movement of arm, special when lifting pots etc.

On admission, her general health was good, she was a well-made, robust young woman. She gave the following history, the tumour had appeared two years previous to her admission to the hospital. It gave her no trouble or inconvenience whatever for a year, when she became unable to some extent, to perform her household duties, specially those involving movement of her right arm. For a short time before her admission, any movement of this arm had become painful. The tumour was situated immediately external to and on the level of the lower half of the scapula of the right side. It extended some distance inferior to the inferior angle of this bone, on manipulation, seemed to be bound to the bone to some extent. On palpation it was felt to be a tense cyst, the size of a cocoanut. Manipulation elicited some amount of tenderness. As the patient had never suffered from the urticaria which usually precedes a guinea-worm abscess, the tumour was diagnosed as a hydatid cyst, though no thrill could be felt.

Treatment. Under chloroform, the skin being thoroughly cleansed, an all other precautions being taken, the tumour

was cut down upon, and an attempt made to dissect it out completely. This was found to be impossible, the capsule being formed of the intermuscular septa, and the fascial sheaths of the latissimus and teres major muscles. The capsule was therefore incised and the ectocyst shelled out. As soon as this structure was punctured, a clear watery fluid escaped, a good deal of it into the wound. This caused no urticaria, inflammation or any other sign of inconvenience. No daughter-cysts were evacuated with the fluid, nor were any found after. The ectocyst was removed all in one piece. The capsule was adherent to the scapula and to the 5th. rib. The wound was sewn up, a drainage tube being inserted for two days, as there was a good deal of oozing of blood. The wound healed by first intention.

The ectocyst was examined microscopically and showed the typical laminated structure, though for a long time no scolices were found. Another careful search, however, was made and scolices demonstrated. The ectocyst when cut, curled up in the typical way.

Case 7. Hydatid cyst in the Parotid Gland. Subbanah, a shepherd, aged 35, from Chintalapalle, came to the hospital on December 12th., 1904, complaining of a tumour in the right parotid region., immediately in front of and slightly below the lobe of the right ear. The tumour gave him no pain. History. The patient had felt some pain just behind his right lower jaw, about three years previous to his admission. He then noticed a small tumour in this region about the size of a haricot bean. The pain very soon dis-

-appeared, but the swelling continued to grow slowly. Native remedies were applied but with no effect. Recently the swelling had reached a sufficient size to interfere with the free movements of the jaw, so the patient sought relief by operation. The fact that the pain was only present at the very beginning of the illness and that it had soon disappeared was specially commented upon by the patient.

On admission, a tumour the size of a large orange, was found in the region stated. It seemed to have deep connect--ions and was evidently a tense cyst. The patient was a robust young man in good general health, with no further swellings in any other part of the body. The diagnosis of hydatid cyst was made and excision was decided upon.

Treatment. On December 14th., under chloroform, an incis--ion was made over the tumour and, as the capsule was found to be simply thickened connective tissue of the parotid gland, it was incised and the ectocyst excised en masse, no attempt being made to remove the capsule. As soon as the tumour was incised, watery fluid escapedof which some part flowed into the tissues of the wound. The ectocyst could not be removed in one piece as in the case just recorded, but was eventually completely removed. A drainage tube was then inserted and the wound closed. The tube was re--moved on the 2nd.day and the wound healed by first inten--tion. On examining the ectocyst microscopically, many scolices were found, movements being noticed in them but no daughter-cysts were present. In this case also, no untoward symptoms supervened on account of the escape of

fluid into the tissues during the operation.

Case 8. Hydatid Disease of the Pleura. Shantudu, a Christian school-boy, aged 16, from Chenegalagudur, came to the hospital on December, 26th., 1904, complaining of three small swellings in the lower part of his chest, and breath--lessness on any exertion.

History. 3 years before his admission into the hospital, that is in February, 1902, I operated on the patient, in his school at Gooty, for empyema of the right side of the chest. He made an uninterrupted and uneventful recovery from that illness. The lung rose well at the time of the operation and the boy regained perfect health. At the time of the operation nothing was noticed to be abnormal in the lower part of the pleura or in the chest at all beyond the early empyema. From that time till August 1904, the boy enjoyed good health and was able to do his school work and take full share in the school games, cricket etc. In Aug. the boy noticed a swelling in the 7th. interspace of the right side, in the mammary line. Two months after this, a second swelling appeared, in the interspace above. After another interval of several weeks, another swelling became evident in the 8th. intercostal space. The patient now began to feel a little weak and noticed that he easily became breathless on exertion. There was no cough, nor any disturbance with his digestion or mental capacity.

On admission, the 3 swellings mentioned were seen, the upper one lying in the mammary line and the others just outside it. The middle tumour, the largest of the three, was

the size of a golf ball, the others were a little smaller. There was no pain connected with the tumours, neither was there any tenderness on palpation. They were felt to be tense cysts, but seemed to be quite discrete as no fluctuation from one to the other could be made out. On explor--ing with a syringe, some clear fluid, not containing albu--men, was withdrawn and a diagnosis of hydatids was arrived at. The percussion note over the lower part of the right side of the chest was dull and along the upper margin of the area of dulness, there was somewhat of an aegophonic charcater about the vocal resonance. The breath sounds could be heard throughout and seemed normal.

Treatment. On December, 31st, under chloroform, an incision was made over the largest of these tumours, and a typical hydatid cyst shelled out, which contained a few daughter-cysts. Other cysts could now be felt and were opened into and removed through the same wound. It was found that the cysts causing the swellings seen externally, were quite dis--crete and after these had been removed through the origin--al wound, other cysts could be felt more deeply situated and posteriorly. Several of these were evacuated through the first wound, but it was necessary to make a second in--cision higher up and more posterior. Through this wound severad more cysts were removed. A through communication was then made and a piece of the eighth rib resected. The patient's condition was rather bad, so that although more cysts could be felt, the wounds were well douched out, large drainage tubes were inserted and dressings applied.

Ten discrete cysts were opened into, some of which contained daughter-bladders. Numerous scolices were found in many of these. The patient's condition being a little better a second operation was performed a fortnight later, when a few more cysts were opened into and cleared out, and a portion of the 7th. rib resected to reach cysts higher up and more deeply situated. Suppuration set in a few days later and the patient began to emaciate rapidly. Ruptured cysts were passed for many days after these operations, in every dressing, but some were passed, now and again for six months. About two months after the first operation, the patient developed a cough, which became very troublesome, but at no time did he spit blood, or pass any hydatid fluid with the sputum. Never at any time, has this ever contained any sign of hydatid material. During the course of the next two months two more operations were performed, at which cysts were removed and the wounds well douched out.

At the end of September, the patient's condition was as follows, the left side of the chest is hypersesonant through-out and at the apex expiration is slightly prolonged, though there are no rales or rhonchi. The apex of the right lung is markedly hyper-resonant and the breathing is almost of the cavernous type, with prolonged expiration. There are a few rales at the end of inspiration, and an occasional rhonchus can be heard. The sputum, which is not copious or nummular, shows no tubercle bacilli although it has been repeatedly carefully examined. The right side of the chest wall has been considerably drawn in and the percus-

A photo of Shantudu, case 8, taken 13 months after the first operation, showing the scars and the drawing in of the right side of the chest wall. (Original).

-sion note is dull to the level of the 3rd. rib in the mammary line. The patient has been operated on four times in all and cysts were removed at each operation except the last. In the middle of July, a large cyst was found in the dressings.

From September, the patient has steadily but surely gain-ed ground. On November 30th, a cyst was found in the dressings, but the wounds have become very small sinuses, from which a bead of pus is passed every day. The patient is able to walk about without feeling much exhaustion.

In this case the cysts were distinct from each other and no general capsule could be found. Each cyst seemed to have its own capsule, so that the condition must have been one of multiple infection. No communication has at any time been found with the liver. At the first operation, the diaphragm was distinctly seen and felt and no perforation could be made out. In view of the previous operation for empyema, the case is of special interest. There was then no sign of hydatid disease. It is possible that infection may have occurred through the wound made nearly three years before the patient's admission. It is supposed by Budd and other Australian surgeons, thatinfection may take place through the air-passages, the capsule of the embryo being dissolved off by the heat of these passages. It is possible therefore, that infection may have taken place through the wound made at the operation for empyema. The case is clear-ly one of hydatid disease of the pleura alone, as there has never been any spitting of blood or hydatid material.

Case 9. Hydatid Cyst of the Lachrymal Gland. John, a Christian cooly aged 30, from Thangatur, came to the hos-pital on January 10th. 1905, with proptosis of the right eye, complete loss of vision, and suffering from a good deal of pain.

History. In May 1904, the patient noticed that his vision was becoming somewhat defective and that his right eye was beginning to bulge a little. There was no pain, so he took no further notice of the condition for some time. The protrusion of the eyeball steadily increased, till in Sept-ember, it had become very marked. Sight, also, had almost gone, so the patient returned to the hospital for treatment. The case was diagnosed as one of sarcoma of the orbit and the patient was advised to have the whole contents of the orbit removed. He would not consent to this and went home to return in January with condition much worse. On his return, a hard tumour could be felt in the right orbit, a little to the outer side of and above the eyeball. No fluctuation was palpable, sight was quite destroyed, and there was a great deal of pain, which had set in two or three weeks before his admission to the hospital. Up till this time, there had been no pain at all, but it was now so severe that the patient at once consented to the removal of the contents of the orbit. The boy had not emaciated since his first visit but the rapid growth and other signs seemed to confirm the previous diagnosis of sarcoma.

Treatment. On January 10th., under chloroform, the whole orbital contents were removed. While the operation was being

performed, a cystic tumour was found, situated above and to the outer side of the eyeball. During the necessary manipulations, this cyst was ruptured and a clear fluid es--caped. The whole cyst was removed en masse, and was found to be a typical hydatid. There were no daughter-cysts, nor have any scolices been found even after prolonged and careful search, but the ectocyst showed the typical lamin--ated structure and presented the feature so characteristic of hydatid cysts, namely the curling up on section, of the ectocyst.

Case 10. Hydatid Disease of the Iliac Bone. Rangannah, a cooly of the Bulja caste, aged 45, from Besthavemala, came to the hospital on March 3rd. 1905, complaining of a swelling in the buttock, which gave him a little pain, and caused a slight lameness.

History. Three years before his admission, the patient felt a little pain in his left hip, soon after which a swell--ing appeared in the buttock of that side. The pain soon ceased but recurred at intervals. The tumour in the butt--ock steadily grew in size, in spite of the native remedies tried. There is a vague history of a fall some years ago which did not seem to injure him in any way.

On admission, the patient was very thin and in a very weak condition, but no organic disease could be found apart from that in the left hip. On examination of the part, a tumour of the size of a cocoanut was noticed occupying the whole of the dorsum of the ilium, and giving a distinct feeling of fluctuation, on palpation. Palpation also elicited a

feeling of crepitation, at the posterior portion of the swelling and on pressure, the tumour sank away as if a her-
-nia had been reduced. The iliac bone seemed to be much thickened and the hip was slightly flexed, when the patient was at rest, though there was no dilliculty in straightening the joint if desired. There was no tenderness. The patient could just hobble along, with the aid of a stick. He had never suffered from any fever.

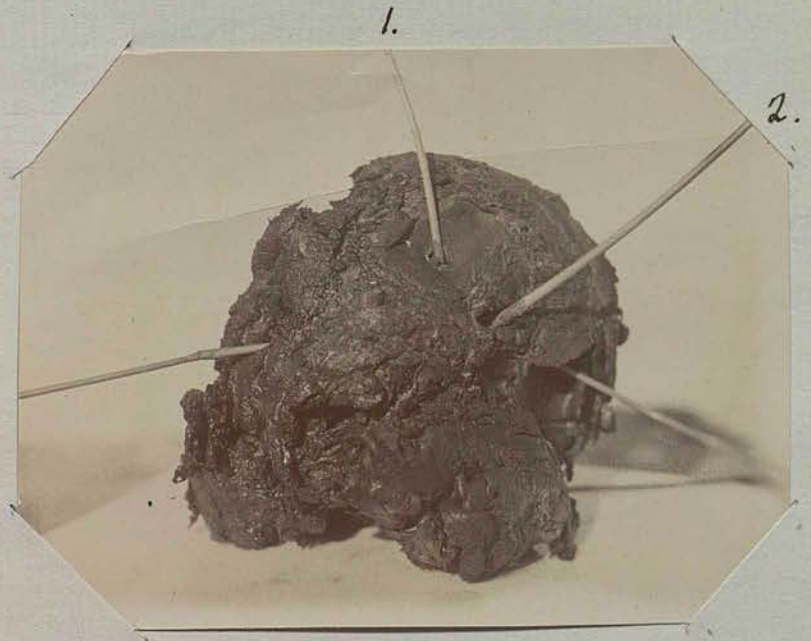
Treatment. On March 7th, under chloroform, an incision was made over the tumour and after the fibres of the gluteus maximus had been separated, a cyst was opened into which was found to be a hydatid. The contents of the cyst that escaped looked very like sago pudding in consistence and colour. Multitudes of small daughter-cysts escaped, none larger than a marble. The large cyst was then cleared out as well as possible by thorough douching, when another one was felt posterior and deep to the first. It was over this second cyst that the sensation of crepitation could be felt. A second incision was made and the finger introduced into a large cyst between which and the interior of the ilium a large communication, sufficient to admit the index finger, existed. This hole was enlarged with bone forceps and the interior of the bone carefully examined. It was found that the ilium had become a mere bag-like cyst, with a very thin layer of osseous tissue on the outside forming the wall of the cyst and that the contents was a mass of hydatid mat-
-ter, of jelly-like consistency, yellowish in colour and containing enormous numbers of cysts the size of peas. The

interior of the cyst was traversed by trabeculae from which spicules of bone had broken off. The contents of the t superficial tumour could be reduced through the hole in the bone which accounted for the suspicion of hernia The material in the outer cysts was exactly similar to that in the bone cavity. It was evident that the disease had started within the bone and had gradually eaten its way through the wall and had then spread under the muscles lying on the dorsum of the ilium. As much of the hydatid material as possible was evacuated and then the cyst washed out thoroughly. No general ectocyst could be found but a large portion of the capsule, formed by a thickening of the muscle sheaths, was removed from the superficial part. Large drainage tubes were inserted into the bone cavity and the usual dressings applied. These had very quickly to be changed as there was a very profuse discharge, in which were many small cysts. The patient suffered a great deal of pain and suppuration set in on the 3rd. day. The dressings were changed twice a day, each time being well soaked with a watery discharge and showing many cysts. At first there was also a good deal of haemorrhage. On the day after operation, the temperature rose to 104° F. The patient rapidly became very weak and sanksteadily till he died, on March 11th four days after operation.

A post mortem examination was obtained and the whole of the left ilium was removed together with the pubic and ischial bones. It was found that the disease had originated in the cancellous tissue of the sacrum near the sacroiliac

Painting of the left ilium removed, post mortem, from a case of Hydatid Disease of Bone. Case 10. 1 = sacro-iliac articulation. 2. = symphysis pubis. 3 = the hole leading into the cavity excavated by the disease. (Original).

Photograph of left ilium, ventral or pelvic aspect, removed post mortem from a case of Hydatid Disease of bone. (Case 10). The straws are inserted into holes eaten through the bone by the disease. 1 = straw inserted into the main hole communicating with the interior of the hollowed out ilium. It is continuous with the eroded cavity at the sacro-iliac articulation. (Original)



Photograph of left ilium, dorsal aspect, of same case as above. Straws 1 and 2 are inserted into holes discovered at the time of operation. 3 is inserted into the eroded acetabulum. (Original)

articulation. Thence it had spread to the left ilium eaten the bone out so as to form a bag of periostium, the walls of which contained only a thin layer of bone, the cavity of the bag being very large and crossed by trabeculae of bone. The two small holes communicating with the tumours described were seen and in addition, a hole was found into the acetab--ulum, which was of fair size, so that it was a marvel that the head of the femur had not been forced into the bone cavitywhen the patient put his weight on his leg, as he did in hobbling about. The accompanying painting and photo-graphs show the condition of things, straws being inserted into the holes leading into the cavity in the bone.

It was found that the only soft tissues invaded were those already described. Else where the disease was confined with-in the periosteum of the sacrum and ilium

Microscopical examination of the cyst contents showed multitudes of cholesterin crystals and the daughter cysts contained splendid examples of scolices. All of these cysts were very small and seemed to lie free, each in its own nook in the cancellous tissue of the bone, in those parts which had not completely broken down.

Case 11. Hydatid Disease of the Lachrymal Gland. Subbiah, a young man aged 20, of the farmer caste, from Pedulapalle, came to the hospital on March 26th. 1905, com--plaining of a small painless tumour situated in the region of the right lachrymal gland. The history given was very indefinite, but the tumour had been noticed about a year before his admission. It was slightly disfiguring and as

the patient wanted to get married, he came to have it re--moved The diagnosis rested between a simple cyst of the lachrymal gland or a hydatid. It was thought that the latter was the probable diagnosis.

On March 27th, under chloroform, the tumour was cut down upon and an attempt made to dissect it out. This was found impossible as the capsule was very intimately connected with the stroma of the gland. In the course of the dissection, the cyst was opened into and a clear watery fluid escaped. Eventually the cyst was removed in two or three pieces. The would healed quickly and without any suppuration. Microscopical examinationof the cyst wall was made, and as there was great doubt whether the cyst was hydatid or not, a piece of the wall was submitted to Dr. Stephens, of the Liverpool Tropical School of Medicine, for examination, who pronounced the case to be one of hydatid origin. No scolices were found but the wall showed the characters of hydatid cyst wall.

SUMMARY

Case 1. Of the Liver, Lindemann's Method of treatment, Cure.
" 2. Liver and Peritoneum, Paracentesis, No cure
" 3. Kidney cyst, Lindemann's Method of treatment, Cure.
" 4. Of Bone, Incision, evacuation and drainage, Death.
" 5. Pleura, " " " , Cure.
" 6. Axilla, Complete Excision, Cure.
" 7. In muscles of the back, Bond's Method, Cure.
" 8. Deep Tissues of Neck (Posterior triangle) Incision and evacuation, Cure
" 9. Of the Parotid Gland, Bond's Method, Cure
" 10. Of the Lachrymal Gland, Complete Excision, Cure.
" 11. Of the Lachrymal Gland, Complete Excision, Cure.